FLIGHT PROJECTS DIRECTORATE

Earth Orbiter-1 (EO-1) Ground System Integration and Test (GSI&T) Plan

March 1997

National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

DRAFT GSI&T PLAN

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Preface

The NMP EO-1 Project Office (Code 426) is administered under the Office of Mission to Planet Earth, NASA Headquarters, and has overall responsibility for the project's development activities. The NMP EO-1 Project Office is responsible for development of the NMP EO-1 system through development and acquisition of individual flight and ground segments. Code 426 will manage the acquisition of the satellite segment, as well as coordination of Flight System and Ground System development, testing, and initial operations with the launch segment at Vandenberg Air Force Base, California.

NMP's first Earth orbiting flight will validate technologies contributing to the reduction in cost of Landsat follow-on missions. The centerpiece is an advanced land imager (ALI) instrument. Once on orbit, EO-1 will provide 100-200 paired scene comparisons between the ALI and the Landsat 7 imager, ETM+. Such a comparison will validate the suitability of the multispectral capability of the ALI.

Mission operations for the EO-1 mission will be conducted from the MOC at GSFC and supported by NASA ground stations at Wallops, Alaska, and McMurdo, Antarctica. The primary ground station will be the Automated Wallops Orbital Tracking Station (AWOTS) at Wallops. NASA stations and the TDRSS will be used for launch support augmentation. 'Normal operations will be conducted by a two person team with support available from other sources (TBD).

The NASA ground segment contribution for EO-1 will utilize the following facilities: Mission Operations Center at GSFC, EO-1 Science Data Center at GSFC, Land Processes Distributed Active Archive Center (LP DAAC) at Sioux Falls, South Dakota, NASA Communications (Nascom).

The primary objective of the EO-1 Ground System Integration and Test Plan is to document the testing methodology used to verify the readiness of the ground system elements identified to support the EO-1 mission. The GSI&T testing conducted will include the interface to the spacecraft, even though it is not technically a ground interface.

Questions concerning this document and proposed changes shall be addressed to:

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Section 1. Introduction

1.1 Purpose

The purpose of this document is to define a comprehensive Integration and Test (GSI&T) Plan which will be used to verify all the mission requirements imposed on the ground system in support of the Earth Orbiter 1 (EO-1) mission. This document baselines tests and requirements for a complete EO-1 Ground System (EGS).

The purpose of GSI&T is to verify:

- FOT Readiness.
- Operations Procedures.
- Ground System Functions.
- Software and Operations Requirements.
- End to End Ground System Readiness for Operations.

Another very important function of GSI&T is to train the FOT.

1.2 Document Scope

1.2.1 The GSI&T Plan Provides:

- Test Management Sections 1 through 3: Defines testing methodology, test team roles and responsibilities, GSI&T activities, test evaluation, Test Discrepancy Reporting (TDR), and test support provided for elements and project activities.

- Test Requirements Database Section 4: Testable requirements and related test objectives.

- Ground Systems Interfaces Section 5: Interfaces relative to mission operations.

- Test Information Sheets Section 6: Provided for each test to ensure that the Ground Data Systems' functional performance meets the requirements as specified in the Detailed Mission Requirements.

- Test Requirements Vs Test Matrix Section 7: A cross reference of test requirements and GSI&T tests which verify them.

- Test Resources Section 8: Descriptions of the facilities required for testing.

- GSI&T Timeline Section 9: An GSI&T test schedule forecast.

- Test Discrepancy Reporting system (TDR) Section 10: Description of the policy and procedures involved with reporting GSI&T test discrepancies.

Section 2. Test Methodology

2.1 Testing Hierarchy

The fundamental concept to the management, methodology, and implementation used in the testing of the EGS is for top down testing. In this concept, system requirements levied on individual elements of the ground system are agreed to, documented, and then subsequently verified during a period of formal Integration and Testing (GSI&T). This is accomplished after a period of parallel implementation and acceptance testing activities conducted by each element. Figure 2-1 provides an overview of the testing hierarchy. Figure 2-2 provides a parallel view of the element and Mission Readiness Test (MRT) activities.

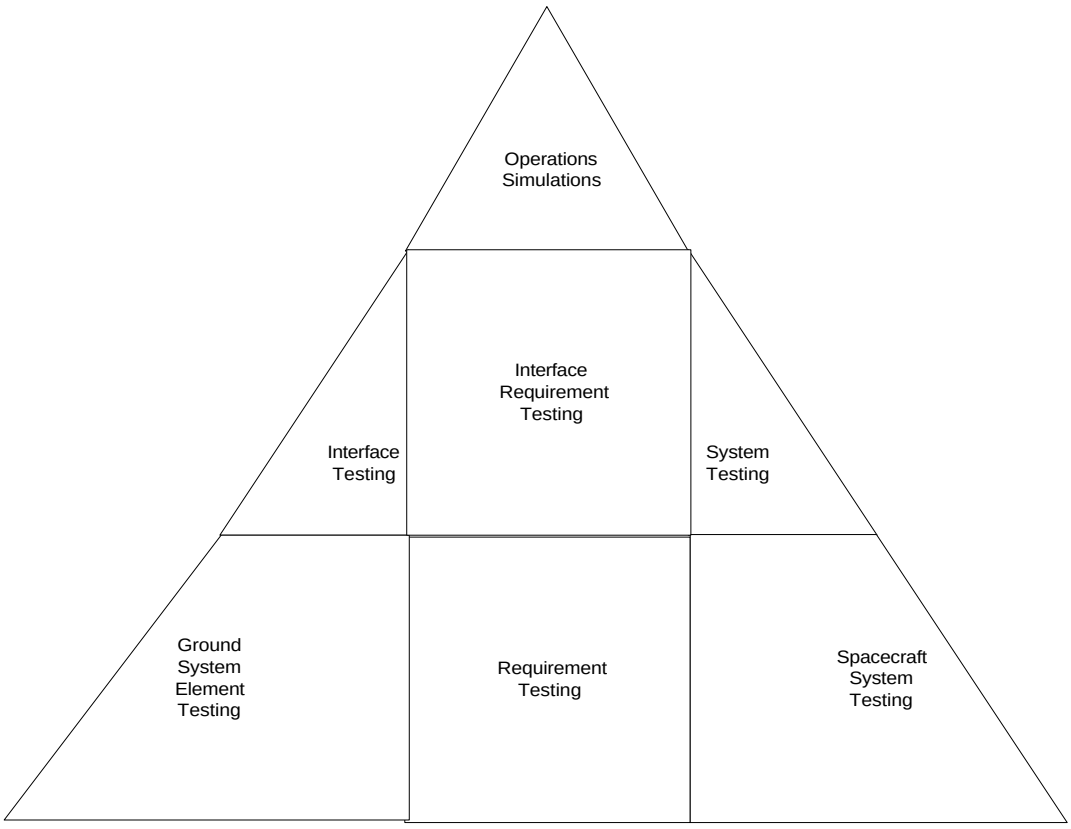


Figure 2-1: Testing Hierarchy

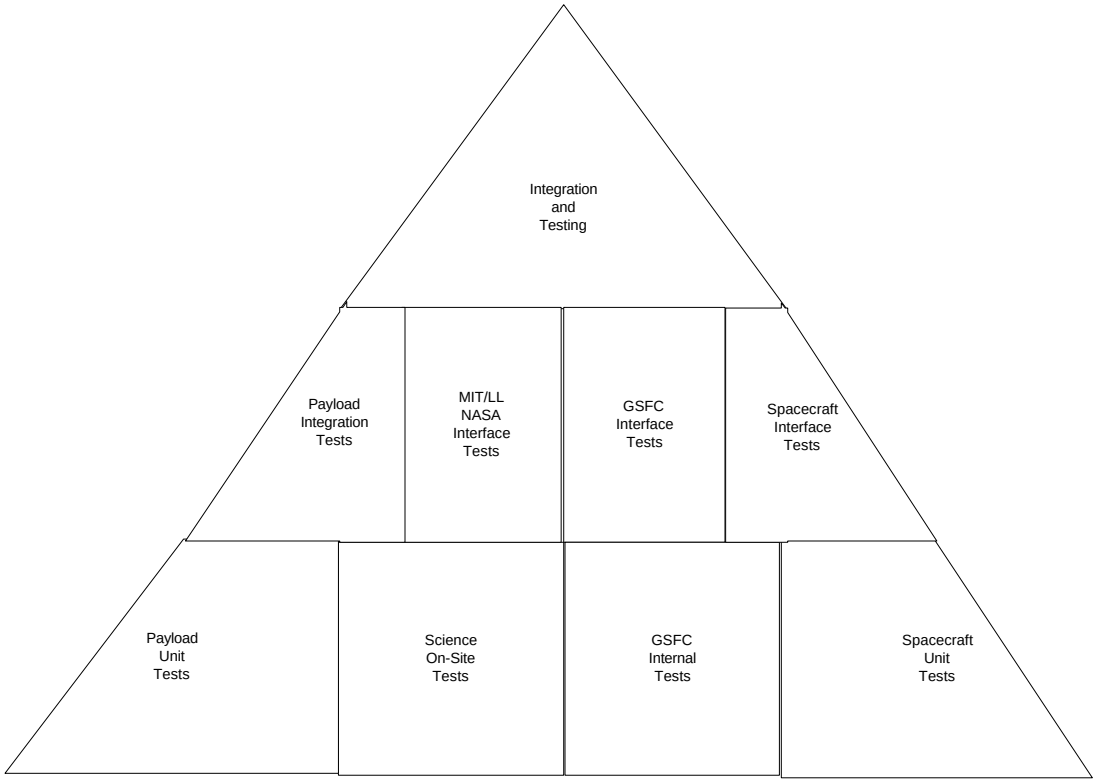


Figure 2-2: Testing Parallels

Following the acceptance testing of the EGS subsystems, initial interface testing between the EGS elements is accomplished. A lead will be chosen for each test. As each test is conducted, the lead will forward a test report that summarizes the results to the EO-1 Mission Readiness Manager (MRM).

The EO-1 MRM will provide the elements with coordinating support as required during the initial element interface testing period. This will include the establishment of a test team forum, support in the formatting and distribution of element supplied briefing message information, test resource coordination, and problem resolution assistance.

EGS mission simulations will be conducted as GSI&T is conducted. They will also take place after GSI&T has been completed. They will be fit in whenever possible. There is a minimum requirement for the number of simulations, but the more simulations run, the better the FOT will be at performing daily operations and contingency operations.

2.2 Test Types

Software validation and test is performed on each individual subsystem before any integrated tests are performed. These tests are specifically used to test the hardware, software, and operability of the subsystems in the EGS. They require a data source, either a simulator or the spacecraft. These tests are similar to what the spacecraft I&T plan calls comprehensive performance tests. This type of test is covered in the S tests.

GSI&T tests test the interfaces between elements, and their specific requirements. In these tests, requirements are tested as stated, and checked off if validated.

Simulations are tests where the primary objective is to train or test the FOT. These can also accommodate testing system functionality. Various types of simulations will be held at all stages of pre launch operations. These simulations will be used as performance evaluators to determine needed training of the FOT.

2.3 Software Validation and Test Process

The key steps involved in developing validation tests are as follows:

- Meeting with all involved to initiate the process.
- Develop a script to follow during the test.
- Develop the necessary procedures to use during the test.
- Conduct the test.
- Report the results.

The pre test meeting will involve all members who are affected by the test. This usually includes all FOT members, key spacecraft I&T members, developers of the subsystems involved, and project personnel. The scripts developed should include high level chronological flows of all test activities, all individual procedures to be executed, interactive inputs of all elements, and hardware configurations and software version numbers. The procedures to be used for testing should be generic enough so that they can be used as is or easily modified to use on-orbit. A test briefing should be generated and sent out to all elements which includes the test date and duration, test participants, data and voice line configuration, test directory, and the high level objectives for the test. After the test is conducted, according to the script, the results of the test should be reported, and a debrief held. The report should include problems encountered, discrepancy reports to be opened, lessons learned, and items requiring re-testing.

For each test, the products that should be generated are as follows:

- Test script.
- Procedure listing.
- Command load listing.
- Sign off sheet.
- Pass plans.
- Test log.
- Test Discrepancy Reports.

2.4 GSI&T Process

2.4.1 Planning and Analysis

The MRM will compile a database of test requirements and test objectives from the EO-1 Detailed Mission Requirements document. This database will be used to create tests which are then cross checked on an EO-1 Requirements versus Test Matrix chart.

The set of tests that will be performed during the GSI&T phase will be developed during the planning and analysis phase.

2.4.2 Integration and Testing

After all elements have completed their acceptance tests and have reported to the MRM that they are ready for integration testing, the EGS I&T will begin.

During the EO-1 GSI&T, a set of integrated tests will be performed to verify the EGS can support all EO-1 Mission Support Requirements contained in the EO-1 Detailed Mission Requirements document. The GSI&T phase will:

- Verify all ground system interfaces support each specific EGS mission function per the requirements identified in the EO-1 Detailed Mission Requirements.
- Verify the capability of the EGS as implemented by the Flight Operations Team to support all EO-1 mission requirements.
- Demonstrate the operational readiness of the EGS to support all EO-1 mission activities and requirements.
- Validate command procedures and command processing.
- Validate telemetry processing.
- Demonstrate end to end functionality of the EGS.
- Demonstrate the ability of the RF system to transmit and receive in the frequencies assigned to it (i.e. RF compatibility testing).

During the evaluation phase, all tested requirements are noted as not verified, partially verified, or fully verified. All EGS discrepancies are documented on a TDR form for follow up and resolution. The TDR review board (TRB), which is made up of the MRM, Ground System Project Manager, Ground System Lead Engineer, Spacecraft Systems Engineer, and the Flight Assurance Manager, will prioritize TDRs and determine if any can be waived, deleted, or if mission requirements can be supported with a reliable work around. Once all the requirements are fully verified, and all TDRs are resolved, the EGS verification process through GSI&T is complete.

See the spacecraft I&T plan for details on the types of tests that will be performed on the spacecraft.

2.5 Simulation Process

Operations scenario simulations are required to validate the readiness of the FOT to perform daily operations, contingency as well as normal. These scenarios can be accommodated during GSI&T or

any time a full data stream is available to monitor and command. The operative word is command. Without being able to send commands or command or table loads, a simulation is not helpful. Simulations "simulate" operations as closely to real conditions as possible. One of the most important simulations held on EO-1 will be a simulation where the FOT prepares the autonomous system to operate for a day without interference from a human. These simulations will consist of monitoring the software to see if it works, but the major part of the work involved will be in the preparation.

Section 3. Test Management

3.1 Overview

This Section defines the EO-1 Mission Readiness Test Team (MRTT) organization. It also defines the basic responsibilities of the participating personnel required to accomplish the defined EO-1 test activities. Figure 3-1 depicts the overall EO-1 MRTT activities. All phases of GSI&T are held to this organization.

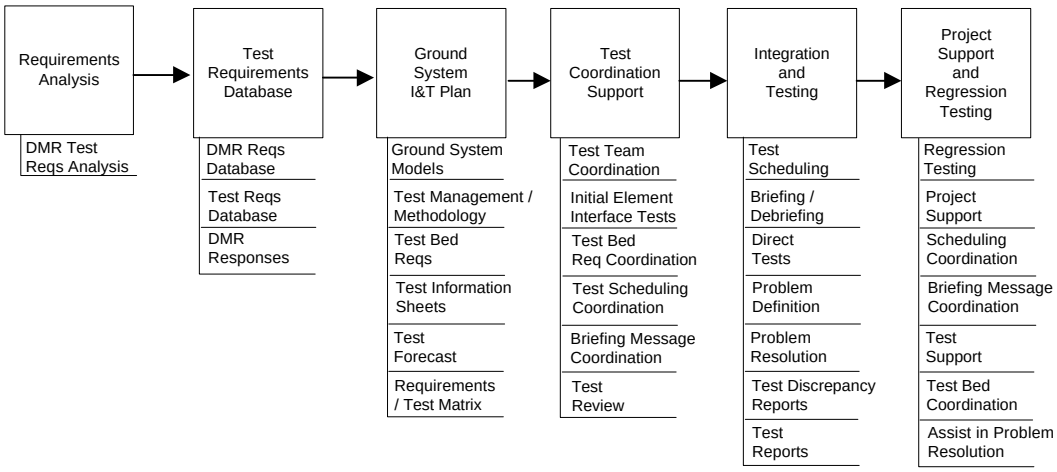


Figure 3-1: Mission Readiness Testing Activities

3.2 MRTT Organization

3.2.1 MRTT

The test team is composed of representatives from each of the supporting system elements and functions under the direction of the MRM. The test team element members are responsible for coordinating acceptance and initial interface testing between elements. Then the test team collectively implements the GSI&T Plan.

3.2.2 Test Team Roles and Responsibilities

Specific roles and responsibilities of the representatives of the test team are as follows:

- MRM: The EO-1 MRM serves as chairman of the EO-1 MRTT and has overall responsibility for verifying that all ground elements are ready to support all phases of the EO-1 mission. This person joins the project very early on to gain a deep understanding of the mission. This person is also the Flight Operations Team Lead. Specifically, in the EGS testing capacity, the MRM will:
    - Chair the MRTT.

- Function as the focal point for all project test and simulation requirements.
- Develop, coordinate, and maintain the GSI&T schedule.
- Provide element and project test coordination support as necessary.
- Receive, consolidate, and disseminate test results.
- Conduct post test critiques.
- Maintain a test discrepancy reporting system and chair the TDR review board.
- Monitor the resolution of test discrepancies.
- Assess overall data system readiness.
- Manage the development of the requirements to be tested.

- Mission Readiness Test Engineer (MRTE): The MRTE is the prime test support contractor assigned to the MRM for the EO-1 mission. This person will join the team when spacecraft I&T begins. They will participate in spacecraft I&T as well as the EGS I&T. Their functions during spacecraft I&T will be as a participant, not a director. The MRTE assists the MRM in all EGS testing activities to include:
  - Mission requirements analysis and test planning.
  - Coordination and generation of test briefing and debriefing messages.
  - Test direction activities assigned by the MRM.
  - Requirements verification, tracking, and test discrepancy reporting.
  - Acting as the Test Director or Test Conductor for various tests as needed.
- Element Representative (ER): The ER has the overall responsibility for the readiness of their element to participate in the test and simulation activities. There will be an ER for each element. Sometimes, different elements will have the same ER due to the small size of the development and operations teams for EO-1. The ER will:
  - Represent their support element on the test team.
  - Contribute to the overall test schedule.
  - Be responsible for the readiness of their support element to participate in test and simulation activities.
  - Forward element TDRs to the MRM.
  - Provide the MRM with element discrepancy information as related to GSI&T TDRs.
  - Provide the MRM with the estimated time to clear or correct test discrepancies.
  - Be responsible for the required test and simulation documentation for their support element.
  - Designate an element Test Conductor (TC) within their section who will be the responsible point of contact to the Test Director (TD) during GSI&T. The ER and TC may be the same person for each element due to the small size of the development and operations teams on EO-1.

3.3 Testing Responsibility

3.3.1 Test Director Responsibilities

During testing, the MRM will assign a TD who will exercise overall test authority and be responsible for verifying specified test objectives. The TD will usually be a member of the Flight Operations Team (FOT). Specifically, the TD will:

- Schedule equipment and personnel required to support the tests.

- Maintain test discrepancy logs and forward them to the MRM.
- Revise test schedules, as required.
- Maintain a central collection point for test logs, test reports, test discrepancy reports, test data, and analysis results during the test. The location of this information will be supplied by the MRM.
- Conduct a pretest briefing for all personnel involved in the test, concentrating on reviewing functions to be verified during the course of the test.
- Conduct the test:
    - Evaluate overall test progress and results and determine the proper courses of action in regards to cancellation, continuation, or modification of remaining test activity.
    - Ensure proper data collection for subsequent analysis.
- Conduct test debriefing:
    - Identify individual problem areas.
    - Identify and correct test procedure errors.
    - Establish estimated time to correct discrepancies.
- Collect test data logs and TDRs. All data will be turned over to the MRM.
- Prepare consolidated readiness reports and forward to the MRM. These reports include element test results and subsystem readiness for integrated testing.
- Assist test team in revising test schedules and enduring timely corrections of discrepancies.

3.3.2 Element Test Conductor Responsibilities

The element test conductor (assigned by the ER) is responsible for the execution of assigned tests for that element. The element test conductor will:

- Ensure proper manning, documentation, and scheduled configuration in preparation for the test.
- Verify actual configuration and assess impact of degraded configuration (equipment, software, etc.).
- Conduct a pretest briefing for all personnel involved in the test, concentrating on reviewing functions to be verified during the course of the test.
- Participate in testing their element with others, as directed by the TD:
    - Evaluate overall test progress and results of their element and determine the proper courses of action in regards to cancellation, continuation, or modification of remaining test activity and advise the TD.
    - Ensure proper data collection for subsequent analysis. Forward results to the TD.
- Participate in MRT debriefing:
    - Identify individual problem areas.
    - Identify and correct test procedure errors.
    - Establish preliminary down time for identified discrepancies.
- Collect test data logs and reports. All data will be turned over to the TD.
- Prepare a consolidated test report from inputs of supporting test positions and forward to the TD and MRM.

3.4 Test Coordination Support

3.4.1 Initial Interface Tests

The test team will be used to support the initial interface tests conducted by the individual elements. The TDR reporting system will not be used for these tests. Each element will use the element's current discrepancy reporting system. Test reports will be forwarded to the MRM for each test conducted.

3.4.2 Project Activities

The test team will also support project simulations. The TDR reporting system will be in effect during these activities. The test discrepancy summary report will be distributed by Operations Readiness and Performance Assurance (ORPA) on a monthly basis via GSFC telemail.

3.4.3 Network Test Coordination Support

The MRM will be supported by the ER for Nascom in coordinating and implementing ground network test activities. The ER for Nascom will be responsible for scheduling required resources and conducting ground network tests prior to the GSI&T phase.

3.5 Test Evaluation and Discrepancy Reporting

3.5.1 TDR Review Board

The TRB is composed of the MRM, Ground System Project Manager, Ground System Lead Engineer, Spacecraft Systems Engineer, and the Flight Assurance Manager. The requirements tested and data collected during a test will be evaluated by the TRB (see Figure 3-2).

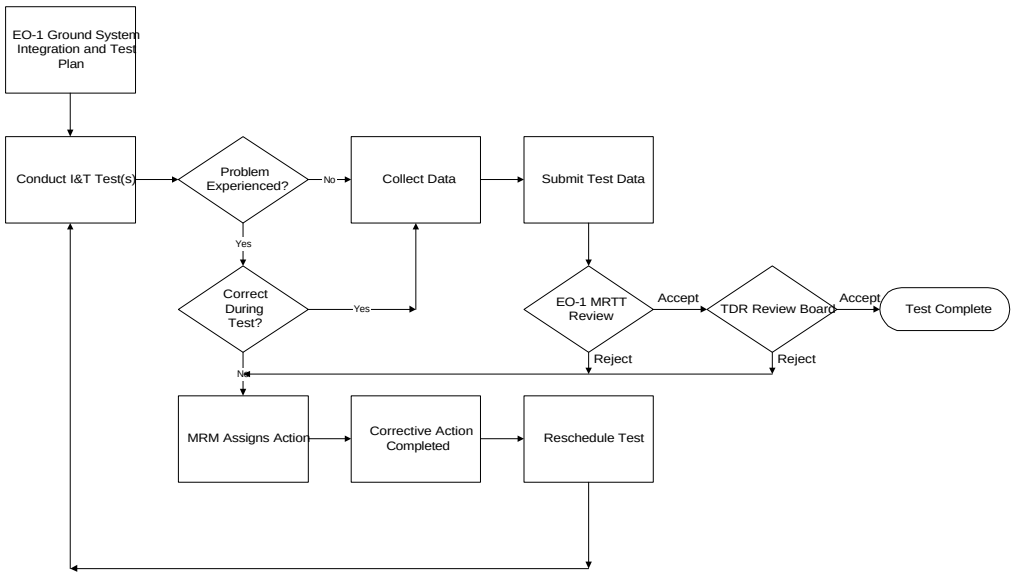


Figure 3-2: Integration and testing Results Review Diagram

3.5.2 Test Discrepancy Reporting Procedure

A TDR will be generated when the performance of a system function being verified during a test does not meet the specified requirement. The TDR will be cross referenced to an element's discrepancy report which documents the same problem. If the element's discrepancy report does not exist, one will be opened within the affected element. The TDR and associated test results will be presented to the TRB for the assignment of a criticality level. TDRs will then be distributed to the responsible elements for investigation and resolution. The Flight Assurance Manager will track TDRs and provide management with current status reports. Test Discrepancy Summary Reports will be distributed on a monthly basis via the GSFC telemail. Once an element reports that a TDR is resolved, the test team will retest the requirement to verify its validity. Results will again be presented to the TRB. Detailed instructions in test discrepancy reporting are found in Section 10 of this test plan.

Data system problems or discrepancies will be assigned a priority level in accordance with the following definitions:

- Critical: System / service cannot perform critical function or imposes major safety hazard. Presents an immediate impact to development, operation, services, or data processing functions; imposes major safety hazard to personnel, systems, or results in loss of one or more essential mission objectives.
- Urgent: System / service substantially impaired. Substantially impacts development, operations, services, or data processing functions; fails to operate within critical performance specification; or cannot effectively fulfill baseline requirements.
- Routine: System / service slightly impaired. Causes minor or no substantial impact to development, operation, services, or data processing functions. Support may be degraded, but mission can still be accomplished.

NOTE

Based on the priority status, the MRM will determine the degree of corrective emphasis necessary to resolve the discrepancy.

Section 4. Test Requirements / Test Objectives

This section contains test requirements and objectives derived from the Detailed Mission Requirements Document by the MRM for system verification.

Requirement Reference #	Source	Test Requirement	Interface From	Interface To	Test Objective (To Verify)
Example	DMR	CMS will validate and translate the weekly instrument observation timeline into weekly stored command loads and transfer to the real time system.	CMS	RTS	CMS loads.

Section 5. Ground System Interfaces

This section contains the EO-1 interface data requirements of the EGS elements:

Interface	From	To	To Verify	Comm Media	Source
EX	EO-1	Wallops	S Band Data Rate X Band Data Rate	RF	DMR

Section 6. Test Information Sheets

The EGS tests are defined using Test Information Sheets (TIS). These tests will functionally exercise the ground system in the normal and Launch and Early Orbit (L&EO) mission modes, using hardware and software designated for mission support.

The successful completion of the following Software Validation Tests will verify the capability of each element to perform the functions necessary to operate EO-1. Each piece of software will most likely have more than one release, and the "Follow Up Release" test shows how each successive release will be handled separate from the initial release.

Test Number	Test Duration	Test Title
S1	2 months	Command Management System Release 1 Testing
S2	2 months	RTS Release 1 Testing
S3	4 hours prior to each spacecraft test	RTS Command and Telemetry Testing
S4	8 hours	MCC Spacecraft Compatibility Testing
S5	4 weeks	Wallops Scheduling Test
S6	3 days	CMS SDC Interface Testing
S7	2 months	FDS Release 1 Testing
S8	2 months	LZP Release 1 Testing
S9	2 months per release	Follow Up Release Testing

The order of these tests will be dictated by the development schedule of their system. The CMS must be tested before the Spacecraft Compatibility test because a load will be sent up.

The successful completion of the following GSI&T tests will verify the EGS's capability to satisfy functional and performance requirements as an integrated system in an operational environment:

Test Number	Test Duration	Test Title
T1	1 week	Baseline EGS Test
T2	1 day	Telemetry and Command Data Processing Test
T3	1 day	FDS Test (Attitude System)
T4	1 day	FDS Test (Orbit System)
T5	1 day	Command Management Test
T6	1 day	Science Data Processing Test
T7	1 day	Spacecraft Computer Data Processing Test
T8	1 day	Telemetry, Tracking, and Command Data Processing Test
T9	8 hours	Launch Site Interface to the GSFC EGS Test
T10	1 week	Fully Integrated Ground System Test

The following simulations will test the functionality of the FOT. These will be repeated as many times as possible throughout the pre mission period, though 2 times with each is required.

Simulation Name	Duration	Verifies
Operations Simulation	4 separate 8 hour tests	The FOT's ability to handle all stages of operations.
End To End Data Flow Simulation	4 hours per test	The FOT's ability to handle pass operations.
Launch Site Testing	8 hours	The FOT's ability to handle L&EO operations.

6.1 Test S1: Command Management Release 1 Testing	
6.1.1 Test Overview (To Verify)	
• All CMS requirements (TBS).	
6.1.2 Supporting Elements and Configurations	
Hardware	Software
Flight Software Facility	TBD
EO-1 Database	Current Release
CMS	Release 1
6.1.3 Prerequisite	
• None	
6.1.4 Test Stimulus	
Stimulus	Source
EO-1 Database	Spacecraft Contractor
EO-1 Command Load Input	MOC
Planning / Scheduling Products	FDS
Flight Software / Table Images	Spacecraft Contractor
6.1.5 Test Scenario / Description	
• The FOT will perform functional tests for each capability delivered with the CMS software release 1. The FOT will coordinate testing with training of FOT members. • Any software related errors or anomalies will be investigated and documented in a Discrepancy Report (DR). • Key CMS software Release 1 capabilities include: • Fill these in here. • The flight software element will provide a flight software table to the CMS for processing and later transfer to the MCC.	

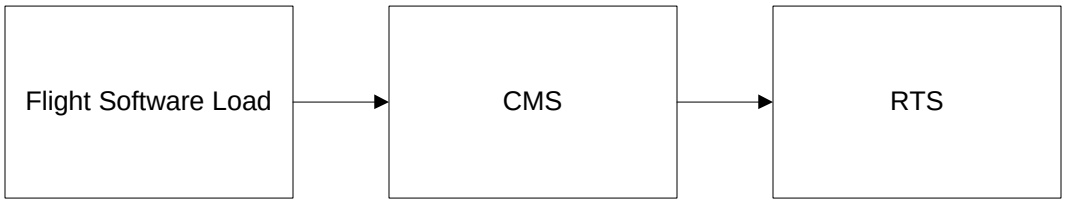


Figure 6-1: Test S1 Data Flow

6.2 Test S2: RTS Release 1 Testing

6.2.1 Test Overview (To Verify)

- Verify functionality of RTS release 1 software.
- Verify operational database and CRT display pages.
- Train FOT to run MCC.

6.2.2 Supporting Elements and Configurations

Hardware	Software
EO-1 Database	Current Release
Spacecraft data or data simulator	TBD

6.2.3 Prerequisite

- Delivery of EO-1 telemetry and command database to the MCC.

6.2.4 Test Stimulus

Stimulus	Source
EO-1 Database	Spacecraft Contractor

6.2.5 Test Scenario / Description

- The FOT will perform functional tests for each capability delivered with the RTS software release 1. The FOT will coordinate testing with training of FOT members.
- Any software related errors or anomalies will be investigated and documented in a Discrepancy Report (DR).
- Key RTS software Release 1 capabilities include:
  - Fill these in here.
- Verification of the MCC ability to accurately utilize the project database is an important objective.
- All commands in the PDB will be transmitted, and all telemetry points essential for mission operations will be displayed on CRT pages. This will ensure that all telemetry parameters are specified correctly in the PDB and displayed properly by the MCC, and commands generated by the MCC correspond with their GSI&T counterparts.

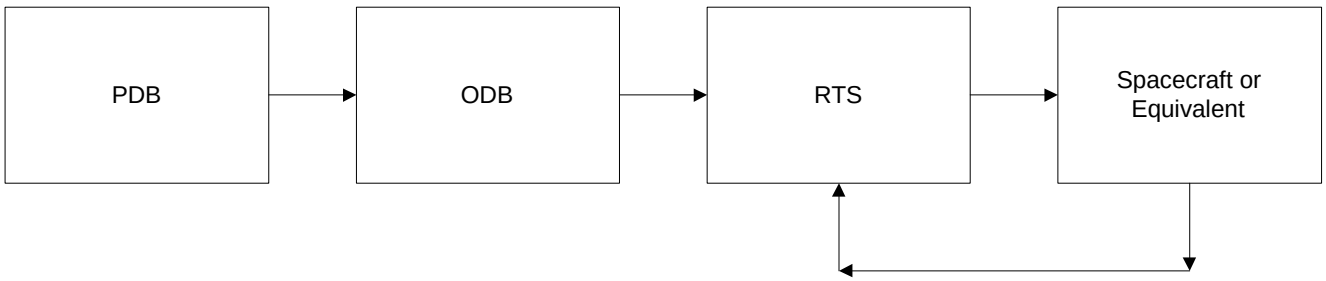


Figure 6-2: Test S2 Data Flow

6.3 Test S3: RTS Command and Telemetry Testing

6.3.1 Test Overview (To Verify)

- Verify compatibility between spacecraft and RTS.
- Verify ODB and CRT display pages.
- Train FOT to run RTS.

6.3.2 Supporting Elements and Configurations

Hardware	Software
EO-1 Database	Current Release
Spacecraft data or data simulator	TBD

6.3.3 Prerequisite

- None.

6.3.4 Test Stimulus

Stimulus	Source
EO-1 Database	Spacecraft Contractor

6.3.5 Test Scenario / Description

- Data flows between the MCC and the (source of sim data, breadboards?) will be routinely scheduled immediately prior to each spacecraft test opportunity. This will help debug any MCC related problems.
- Spacecraft no-op commands will be sent to the (TBD) to test the command interface. Once this link is established, all available database commands will be transmitted.
- Primary goals of this testing include:
    - Receive telemetry at all data rates and all formats.
    - CCSDS command mode checks.
    - Verify receipt of valid ODB commands (by incrementing counters).
    - Comparison of data quality statistics.
- Basic command functionality checks will include:
    - SSR and WARP playback commands.
    - Data rate change commands.
    - Telemetry on and off commands.

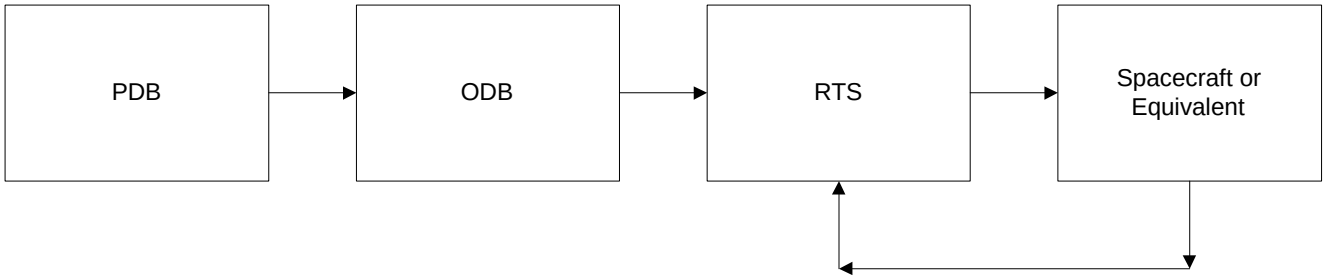


Figure 6-3: Test S3 Data Flow

6.4 Test S4: MCC Spacecraft Compatibility Testing

6.4.1 Test Overview (To Verify)

- There will be 4 of these tests, each lasting 8 hours.
- Test 1:
  - Establish basic command and telemetry interface between the MCC and the spacecraft.
  - Develop and test operational procedures and display page capability.
- Test 2:
  - Utilize the spacecraft to simulate various mission scenarios.
  - Develop and test procedure and display capability.
  - Exercise real time scenarios.
- Test 3:
  - Verify current software releases.
  - Verify the ability of the FOT to generate a command load from a SDC supplied timeline for scene taking.
- Test 4:
  - Verify command and telemetry link between MOC and spacecraft using latest release software.

6.4.2 Supporting Elements and Configurations

Hardware	Software
EO-1 Database	Current Release
Spacecraft	TBD
MCC	Current release
CMS	Current release
LZP	Current release
Nascom	N/A
Flight software facility	TBD
SDC	TBD

6.4.3 Prerequisite

- Test 1:
  - Installation of all necessary Nascom equipment for link between the spacecraft and the MOC.
  - Successful completion of MCC and CMS software release 1 testing.
  - Integration of the spacecraft computer, power subsystems, and ACS components.
  - Completion of GSI&T flight software acceptance testing.
- Test 2:
  - Completion of integration of all flight hardware components.
- Test 3:
  - FOT acceptance of current software releases.
  - Completion of integration of instrument with the spacecraft.
  - Receipt of timeline from SDC.
- Test 4:
  - N/A

6.4 Test S4: MCC Spacecraft Compatibility Testing

6.4.4 Test Stimulus

Stimulus	Source
EO-1 Database	Spacecraft Contractor
Hand-over of the spacecraft	Spacecraft I&T Team

6.4.5 Test Scenario / Description

- These tests will be recorded for later distribution to the ground stations.
- Data will be flowed in parallel to the MCC and the LZP for these tests.
- Current software releases will be used for these tests.
- Handover of the spacecraft will be in a mutually agreed upon configuration.
- Test 1:
    - A series of basic operational procedures will be run to perform basic operations such as command load uplinks, WARP dumps, housekeeping data dumps, and table load/dump operations.
    - The LZP will transfer data to the SDC for analysis.
    - Offline processing of the data will be performed after testing. These activities will include:
        - History delog/replay.
        - Report generation.
        - Trending operations.
        - Data archival.
- Test 2:
    - This test should be run just before the Spacecraft Comprehensive Functional test.
    - Other aspects of this test are identical to Test 1.
- Test 3:
    - The first two hours of this test will involve routine testing of procedures for basic MCC software verification purposes. The remainder of the test will be a simulation run via a command load.
    - The MCC will perform attitude extraction and transfer the data files to the FDS.
    - Trending will be performed on the data off-line.
- Test 4:
    - This will be the last test of the MOC with the spacecraft before it is shipped to the launch site.
    - During this test, any as yet untested (by the FOT) spacecraft capabilities will be exercised, as well as re-test of any previous failed objectives.
    - The MCC will perform attitude extraction and transfer the data files to the FDS.
    - Trending operations will be performed (see Test 1).

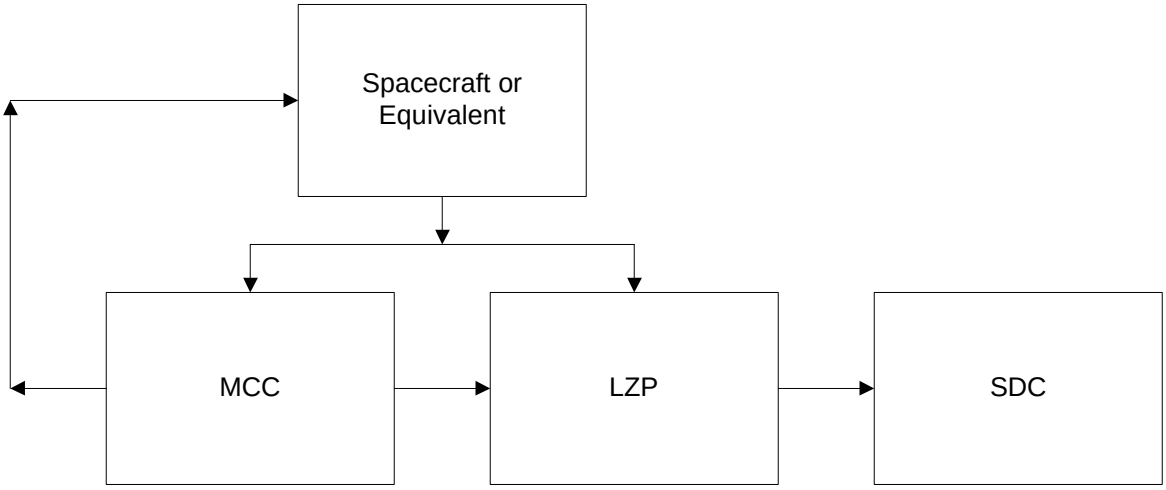


Figure 6-4a and b: Test S4 #1 and #2 Data Flow

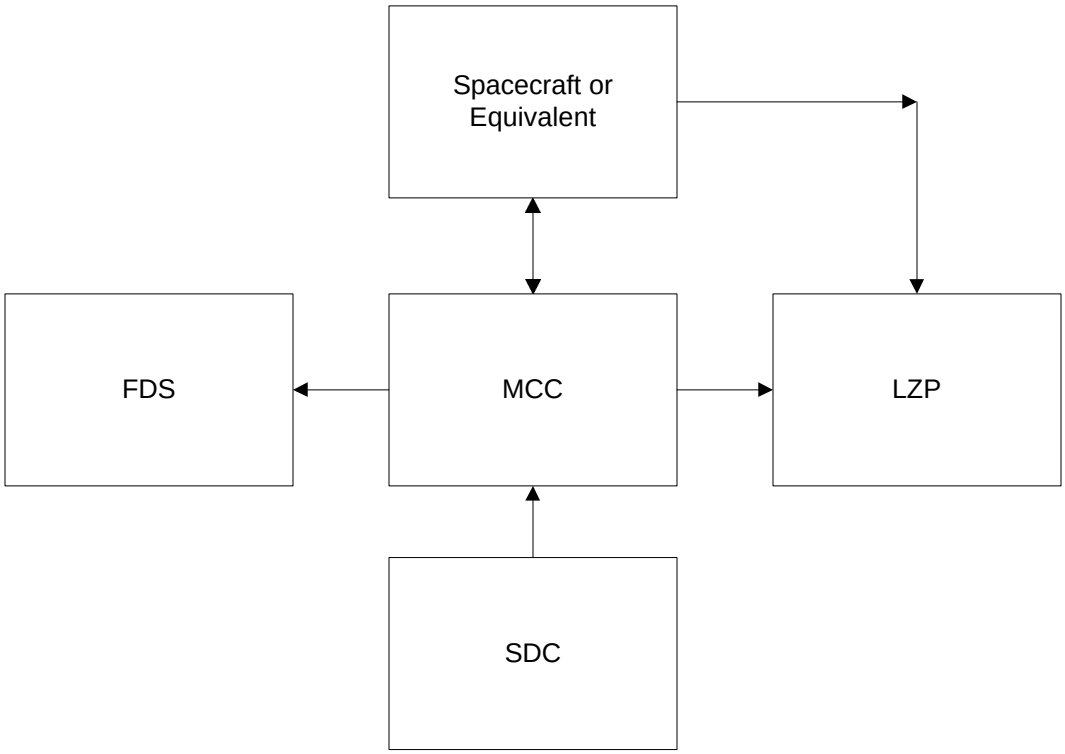


Figure 6-4c: Test S4 #3 Data Flow

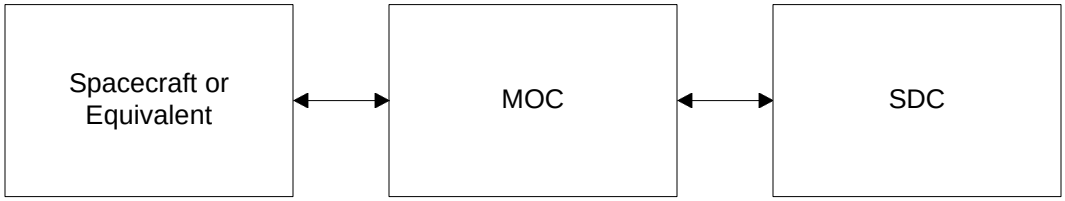


Figure 6-4d: Test S4 #4 Data Flow

6.5 Test S5: Wallops Scheduling Test

6.5.1 Test Overview (To Verify)

- Verify functions of the Wallops Scheduling System.
- Train the FOT in scheduling operations activities.

6.5.2 Supporting Elements and Configurations

Hardware	Software
EO-1 Database	Current Release
Spacecraft data or data simulator	TBD
MCC	Current release
CMS	Current release
LZP	Current release
Nascom	N/A
Flight software facility	TBD
SDC	TBD
FDS	Current release
Wallops Scheduling Group	TBD

6.5.3 Prerequisite

- None.

6.5.4 Test Stimulus

Stimulus	Source
EO-1 Database	Spacecraft Contractor
Hand-over of the spacecraft	Spacecraft I&T Team

6.5.5 Test Scenario / Description

- During this test the Wallops Scheduling Group will execute all the normal activities required to generate a weekly schedule for EO-1 contacts.
- Full scheduling cycle will be simulated, beginning 4 weeks prior to the event week (T-4 week) when predicts are generated, through generation of the confirmed schedule during T-1 week. All normal ops products (e.g. Strawman and Forecast schedules) will be produced.
- Contacts will be selected from the PSAT (TBD).
- This test may be repeated later after the last CMS release is delivered. At that point, the CMS should be able to automatically ingest planning products from the on line Wallops scheduling function, as well as create schedules autonomously.
- Perform tests related to the scheduling system including:
    - Transmission of the predicted site acquisition table files from the FDS to Wallops autonomously.
    - Transmission of schedule requests autonomously from the MCC to Wallops.
    - Generation and transmission of generically scheduled supports.
    - Schedule conflict resolution by the WSG.
    - Receipt of schedules from Wallops autonomously.
    - Autonomous generation of schedule reports.

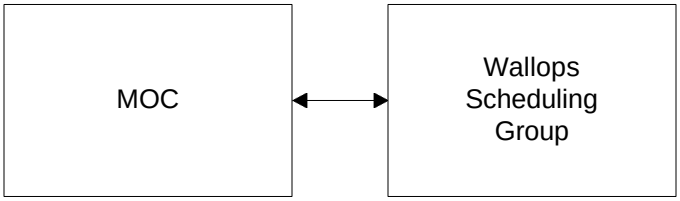


Figure 6-5: Test S5 Data Flow

6.6 Test S6: CMS SDC Interface Testing

6.6.1 Test Overview (To Verify)

- Verify connectivity between the CMS and the SDC.
- Train FOT.

6.6.2 Supporting Elements and Configurations

Hardware	Software
CMS	Current Release
SDC	TBD

6.6.3 Prerequisite

- Delivery of CMS software.
- Data connections between the MOC and SDC.

6.6.4 Test Stimulus

Stimulus	Source
Science planning and scheduling concept	Project Scientists, Landsat 7 Scientists

6.6.5 Test Scenario / Description

- The version of the CMS used must have the capability for electronic transfers (via FTP) to and from the SDC.
- This test is only to verify the connectivity between these two elements. The FOT will coordinate verification of data receipt with the scientists.
- Files to be transferred from the CMS to the SDC include:
    - Command load integrated prints.
    - Observation timeline validation reports.
    - Project database files.
    - Operational database files.
    - Spacecraft status reports.
    - Anomaly reports.
    - Flight dynamic reports.
- Files to be transferred from the SDC to the CMS include:
    - Mission timeline files.
    - Scene request files which will include times and duration as well as commands to send up to perform the scene taking.
    - Scene priority reports.
    - Calibration request reports along with the required commands or procedures to perform the calibrations.
    - Reports containing any special commands or procedures to be performed on the instrument, along with what to expect in response to the procedure or commands.
    - Reports containing any special telemetry to watch for, why, and what to do if something changes.
- Data will be transferred over a dedicated T1 line between the MOC and SDC (TBD).

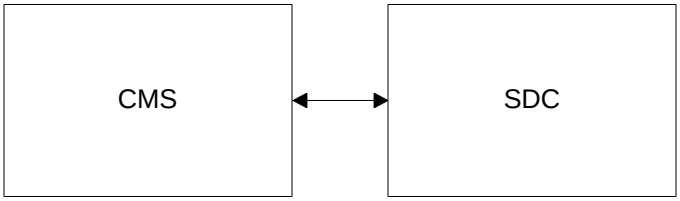


Figure 6-6: Test S6 Data Flow

6.7 Test S7: FDS Release 1 Testing	
6.7.1 Test Overview (To Verify)	
• Verify functionality of FDS release 1 software. • Verify TBD. • Train FOT to run FDS.	
6.7.2 Supporting Elements and Configurations	
Hardware	Software
EO-1 Database	Current Release
Spacecraft data or data simulator	TBD
6.7.3 Prerequisite	
• None.	
6.7.4 Test Stimulus	
Stimulus	Source
EO-1 Database	Spacecraft Contractor
6.7.5 Test Scenario / Description	
• The FOT will perform functional tests for each capability delivered with the FDS software release 1. The FOT will coordinate testing with training of FOT members. • Any software related errors or anomalies will be investigated and documented in a Discrepancy Report (DR). • Key FDS software Release 1 capabilities include: • Fill these in here. • Verification of the FDS ability to operate autonomously is an important objective. • All files to be transferred to and from the FDS will be tested.	

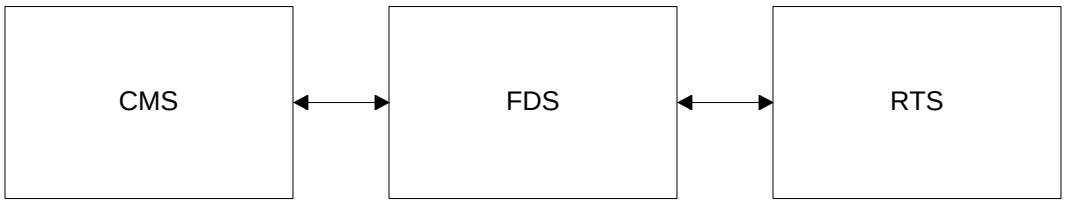


Figure 6-7: Test S7 Data Flow

6.8 Test S8: LZP Release 1 Testing	
6.8.1 Test Overview (To Verify)	
• Verify functionality of LZP release 1 software. • Verify TBD. • Train FOT to run LZP.	
6.8.2 Supporting Elements and Configurations	
Hardware	Software
EO-1 Database	Current Release
Spacecraft WARP data (origin of data is TBD)	TBD
6.8.3 Prerequisite	
• None.	
6.8.4 Test Stimulus	
Stimulus	Source
TBD	TBD
6.8.5 Test Scenario / Description	
• The FOT will perform functional tests for each capability delivered with the LZP software release 1. The FOT will coordinate testing with training of FOT members. • Any software related errors or anomalies will be investigated and documented in a Discrepancy Report (DR). • Key LZP software Release 1 capabilities include: • Fill these in here. • Verification of the LZP ability to operate autonomously is an important objective. • All files to be transferred to and from the LZP will be tested.	

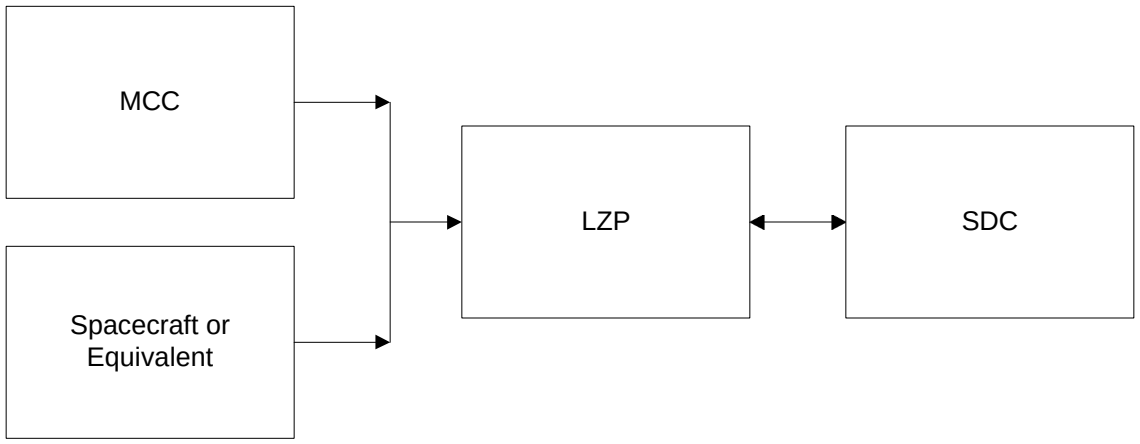


Figure 6-8: Test S8 Data Flow

6.9 Test S9: Follow Up Release Testing	
6.9.1 Test Overview (To Verify)	
• Verify functionality of software release X software. • Train FOT to run new release.	
6.9.2 Supporting Elements and Configurations	
Hardware	Software
Software being tested	Current Release and New Release
Spacecraft data or data simulator	TBD
6.9.3 Prerequisite	
• Successful acceptance of previous release.	
6.9.4 Test Stimulus	
Stimulus	Source
New and old version of software	N/A
6.9.5 Test Scenario / Description	
• The FOT will perform functional tests for each capability delivered with the software release X. The FOT will coordinate testing with training of FOT members. • Any software related errors or anomalies will be investigated and documented in a Discrepancy Report (DR). • Key software Release X capabilities to be tested will be included in the test documentation.	

The Data Flow chart for this will be the same as the test for the first release of each type of software tested.

6.10 Test T1: Baseline EGS Test

6.10.1 Test Overview (To Verify)

- The EGS's integrated capability to provide the interface and product transfers among all elements.
- The capability of the MOC to receive, capture, process, and store telemetry at TBD data rates in all of the EO-1 supporting ground station modes.
- The capability of the RTS to interface with the CMS for the transfer of those tables, images, command loads, files, and reports necessary for load generation.
- The capability of the CMS to interface with the FDS, RTS, and SDC to obtain those files, inputs, images, and updates required for load generation.
- The capability of the FDS to provide planning products, such as attitude data, orbit data, ADCS subsystem data, and event data, to the CMS.
- The capability of the FDS to receive and maintain the flight software and downlink images necessary to generate table and image updates for the RTS via the CMS.
- The capability of the RTS to transfer commands and loads in all of the EO-1 supporting ground station modes.

6.10.2 Supporting Elements and Configurations

Hardware	Software
SDC	TBD
MIT/LL	TBD
FDS	TBD
LZP	TBD
RTS	TBD
- EO-1 Database	
CMS	TBD
Nascom	N/A

Data and Voice Circuits as Described in Section 6.1.7

The baseline test assumes the spacecraft will be at Swales.

6.10.3 Prerequisite

- Completion of element acceptance and initial interface tests.
- EO-1 database delivered to CMS and the RTS.

6.10.4 Test Stimulus

Stimulus	Source
EO-1 Telemetry Data	EO-1 Data Tapes or the real Spacecraft
EO-1 Database	TBD
EO-1 Command Load Input	MOC
Planning / Scheduling Products	FDS
Flight Software / Table Images	Spacecraft Contractor
Daily Command Loads, Pass Plans, and Printouts	CMS

6.10.5 Test Scenario / Description

- Pre-test activities will include:
    - FDS will interface with CMS to transmit those files needed for load generation.
    - Spacecraft Contractor will interface with CMS to deliver the necessary tables, loads, and

6.10 Test T1: Baseline EGS Test

images needed for load generation.

- CMS will use the products received from FDS and Spacecraft Contractor to generate loads needed to conduct this test.

- The GSI&T Test Director (TD) will provide a briefing message to ensure the completion of the off-line preparations.
- CMS will ensure reception and processing of all inputs necessary to produce EO-1 loads while maintaining continuity.
- CMS will electronically transfer all images, C&DH loads, table loads, and flight software loads to the RTS.
- SDC and/or MIT/LL will flow data at all EO-1 rates used using all of the EO-1 supporting ground station modes to the MOC.
- After good lock is established on the low rate data, the RTS will begin transmitting real time commands and loads to the spacecraft. Command echo verification is expected in the telemetry. This process will be repeated using all of the data rates and all of the supporting ground stations.
- Element test reports, supporting data, and Test Discrepancy Reports (TDR) will be provided to the TD.

6.10.6 Expected Results for Successful Test

a) Validate each element's software in reference to the requirements in paragraph 6.1.7.

6.10.7 Test Requirements

Reference Number	Test Requirement	Test Objective (To Verify)
EX	CMS will perform command load error and constraint checks.	Command load error checks Constraint checks

All requirements to be tested will be listed in this table.

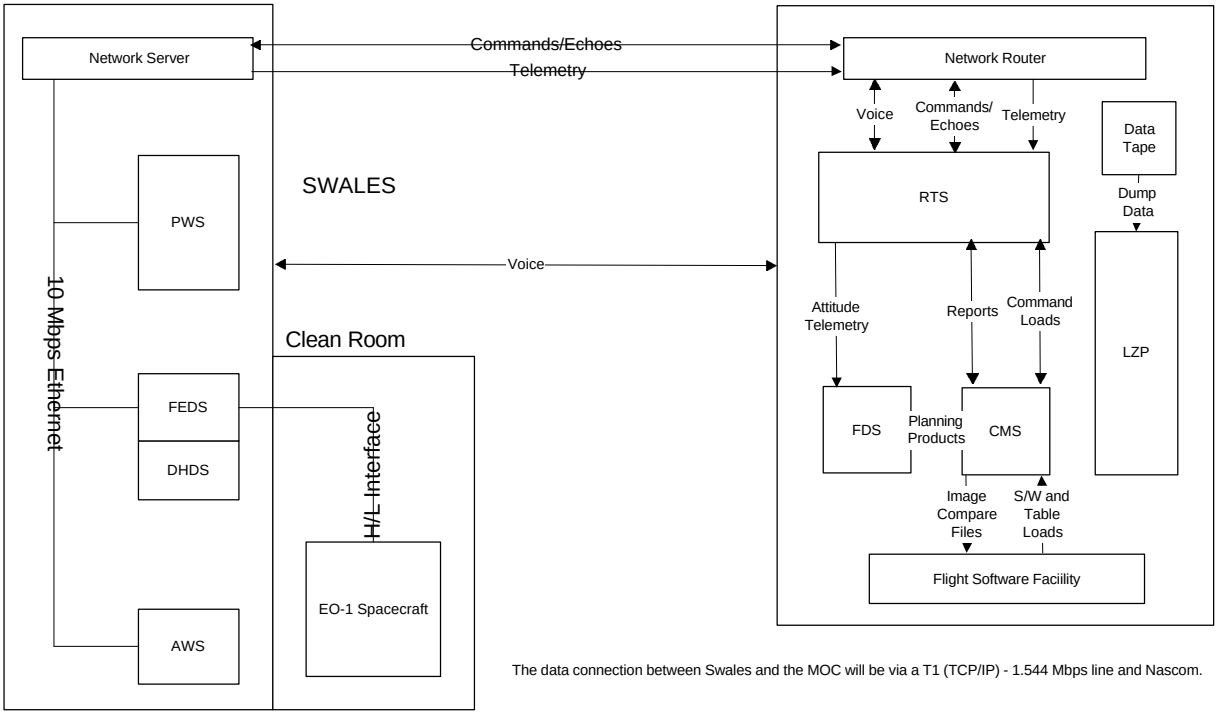


Figure 6-9: Test T1 Data Flow

6.11 Test T2: Telemetry and Command Data Processing Test

6.11.1 Test Overview (To Verify)

- The EGS's integrated capability to provide real time commands and telemetry processing while in any operational mode in accordance with the test requirements in Section 6.2.7.
- The capability of the MOC to capture, record, and process all telemetry at required real time (S Band 3 Mbps) and playback rates (playback rates TBD) in the mode of the ground station being used.
- The capability of the MOC to transmit 2 kbps real time commands and receive command echoes while receiving telemetry in the mode of the ground station being used.
- The capability of the FDS to receive attitude data from the RTS.
- The capability of Nascom to provide all Data and Voice circuits sufficient to support this test.

6.11.2 Supporting Elements and Configurations

Hardware	Software
SDC	TBD
MIT/LL	TBD
FDS	TBD
LZP	TBD
RTS	TBD
- EO-1 Database	
CMS	TBD
Nascom	N/A
- Data and Voice Circuits	
as Described in Section 6.2.7	

6.11.3 Prerequisite

- Completion of element acceptance and initial interface tests.
- Recorded or simulated spacecraft data or real spacecraft with data running.

6.11.4 Test Stimulus

Stimulus	Source
EO-1 Telemetry Data - 3 Mbps - Playback Rate	Recorded, simulated, or real time spacecraft data in Nascom block format with appropriate source codes depending upon the station being simulated.
EO-1 Command Data - 2 kbps	MOC
Spacecraft Database	Spacecraft Contractor

6.11.5 Test Scenario / Description

- The MOC Test Conductor (TC) will initialize all Voice and Data circuits according to the briefing message.
- The GSI&T Test Director (TD) will provide a pretest briefing.
- Real or simulated real time data will be sent to the MOC in the format mentioned above.
- The MOC will receive, capture, record, process, and display telemetry at 3 Mbps.
- The source of the real time data will ensure the appropriate data rates and source codes were received.
- The MOC will transmit 2 kbps real time commands to the source of the real time data while

6.11 Test T2: Telemetry and Command Data Processing Test

receiving telemetry. Verification of commands will be accomplished via telemetry response from the source of the real time data.

- The MOC will also provide various accounting, recording, status, and summary displays and reports.
- The MOC will send real time and playback attitude data to the FDS.
- Upon test completion, the TD will conduct a debriefing and afterward release all supporting elements.
- Element test reports, supporting data, and Test Discrepancy Reports will be provided to the TD.

6.11.6 Expected Results for Successful Test

- Verification of test requirements per criteria furnished in paragraph 6.2.7.
- Execution of information displays.
- Post test processing of data (archive, history, and attitude) and tapes.

6.11.7 Test Requirements

Reference Number	Test Requirement	Test Objective (To Verify)
EX	FDS will receive real time and playback attitude data from the RTS	Real-time attitude data Playback attitude data

All requirements to be tested will be listed in this table.

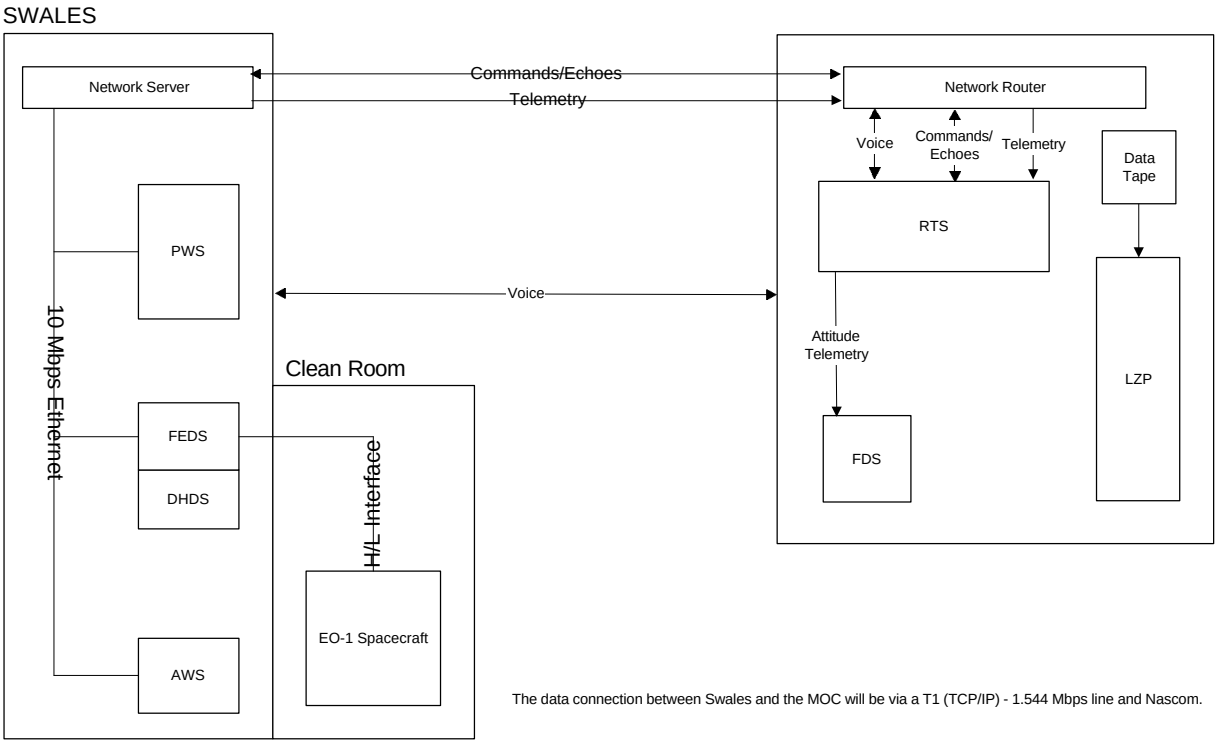


Figure 6-10: Test T2 Data Flow

6.12 Test T3: FDS Test (Attitude System)

6.12.1 Test Overview (To Verify)

- The FDS's integrated ability to accurately verify on board spacecraft attitude and ground computation of sensor calibration parameters.
- TBD

6.12.2 Supporting Elements and Configurations

Hardware	Software
SDC	TBD
MIT/LL	TBD
FDS	TBD
LZP	TBD
RTS	TBD
- EO-1 Database	
CMS	TBD
Ground station	TBD
- Scheduling system	
Nascom	N/A
- Data and Voice Circuits	
as Described in Section 6.1.7	

6.12.3 Prerequisite

- Completion of element acceptance and initial interface tests.

6.12.4 Test Stimulus

Stimulus	Source
EO-1 Telemetry Data	EO-1 Data Tapes or the real Spacecraft
EO-1 Command Data	MOC
Daily command loads, pass plans, and printouts	CMS
EO-1 data products/Vectors	FDS
Project data base	Spacecraft Contractor
Flight software/Table images	Flight Software Maintenance
Scheduling system equipment	Ground Station

6.12.5 Test Scenario / Description

- TBS

6.12.6 Expected Results for Successful Test

- TBS

6.12.7 Test Requirements

Reference Number	Test Requirement	Test Objective (To Verify)
EX	CMS will perform command load error and constraint checks.	Command load error checks Constraint checks

All requirements to be tested will be listed in this table.

Figure 6-11: Test T3 Data Flow

6.13 Test T4: FDS Test (Orbit System)

6.13.1 Test Overview (To Verify)

- The FDS's integrated ability to accurately verify spacecraft orbit determination, orbit propagation and trajectory control (on board, prime; ground, contingency).
- TBD

6.13.2 Supporting Elements and Configurations

Hardware	Software
SDC	TBD
MIT/LL	TBD
FDS	TBD
LZP	TBD
RTS	TBD
- EO-1 Database	
CMS	TBD
Ground station	TBD
- Scheduling system	
Nascom	N/A
- Data and Voice Circuits	
as Described in Section 6.1.7	

6.13.3 Prerequisite

- TBS

6.13.4 Test Stimulus

Stimulus	Source
EO-1 Telemetry Data	EO-1 Data Tapes or the real Spacecraft
EO-1 Command Data	MOC
Daily command loads, pass plans, and printouts	CMS
EO-1 data products/Vectors	FDS
Project data base	Spacecraft Contractor
Flight software/Table images	Flight Software Maintenance
Scheduling system equipment	Ground Station

6.13.5 Test Scenario / Description

- TBS

6.13.6 Expected Results for Successful Test

- TBS

6.13.7 Test Requirements

Reference Number	Test Requirement	Test Objective (To Verify)
EX	CMS will perform command load error and constraint checks.	Command load error checks Constraint checks

All requirements to be tested will be listed in this table.

Figure 6-12: Test T4 Data Flow

6.14 Test T5: Command Management Test

6.14.1 Test Overview (To Verify)

- The EGS's integrated capability to provide the interface and product transfers among those elements which have a part in the EO-1 command management effort in accordance with the test requirements in Section 6.3.7.
- The capability of the RTS to interface with the CMS for the transfer of those tables, images, command loads, files, and reports necessary for load generation.
- The capability of the CMS to interface with the FDS, flight software maintenance facility, and RTS to obtain those files, inputs, images, and updates required for load generation.
- The capability of the FDS to provide planning products, such as attitude data, orbit data, ADCS subsystem data, and event data, to the CMS.
- The capability of the FDS to receive and maintain the flight software and downlink images necessary to generate table and image updates for the RTS via the CMS.

6.14.2 Supporting Elements and Configurations

Hardware	Software
SDC	TBD
MIT/LL	TBD
FDS	TBD
LZP	TBD
RTS	TBD
- EO-1 Database	
CMS	TBD
Flight Software Facility	TBD
Nascom	N/A
- Data and Voice Circuits as Described in Section 6.3.7	

6.14.3 Prerequisite

- Completion of element acceptance and initial interface tests.
- EO-1 database delivered to CMS.

6.14.4 Test Stimulus

Stimulus	Source
EO-1 Telemetry Data	EO-1 Data Tapes or the real Spacecraft
EO-1 Database	TBD
EO-1 Command Load Input	MOC
Planning / Scheduling Products	FDS
Flight Software / Table Images	Spacecraft Contractor
Daily Command Loads, Pass Plans, and Printouts	CMS
Scene Taking Requests	SDC

6.14.5 Test Scenario / Description

- Pre-test activities will include:
    - FDS will interface with CMS to transmit those files needed for load generation.

6.14 Test T5: Command Management Test

- Spacecraft Contractor will interface with CMS to deliver the necessary tables, loads, and images needed for load generation.
- CMS will use the products received from FDS and Spacecraft Contractor to generate loads needed to conduct this test.

- The GSI&T Test Director (TD) will provide a briefing message to ensure the completion of the off-line preparations.
- CMS will ensure reception and processing of all inputs necessary to produce EO-1 loads while maintaining continuity.
- CMS will electronically transfer all images, C&DH loads, table loads, and flight software loads to the RTS.
- After good lock is established on the low rate data, the RTS will begin transmitting real time commands and loads to the spacecraft. Command echo verification is expected in the telemetry.
- Loads generated during this off-line processing test will be verified for later uplink during Test 7.
- Element test reports, supporting data, and Test Discrepancy Reports (TDR) will be provided to the TD.

6.14.6 Expected Results for Successful Test

- Validate each element's software in reference to the requirements in paragraph 6.1.7.

6.14.7 Test Requirements

Reference Number	Test Requirement	Test Objective (To Verify)
EX	CMS will perform command load error and constraint checks.	Command load error checks Constraint checks

All requirements to be tested will be listed in this table.

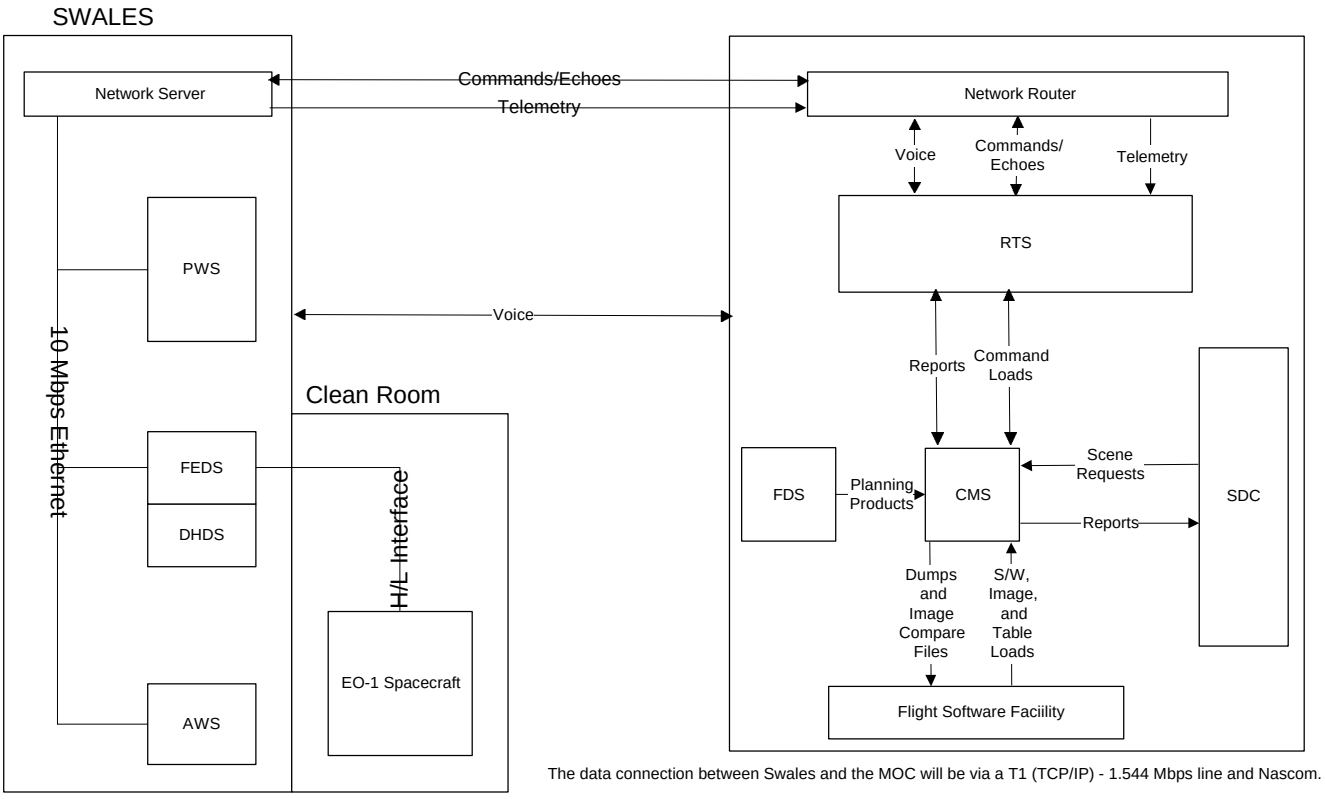


Figure 6-13: Test T5 Data Flow

6.15 Test T6: Science Data Processing Test

6.15.1 Test Overview (To Verify)

- The EGS's integrated capability to provide telemetry processing in support of EO-1 spacecraft operations in accordance with the test requirements in Section 6.4.7.
- The capability of the spacecraft to transmit telemetry at all rates to the MOC.
- The capability of the MOC to transfer 2 kbps real time commands and loads to the spacecraft and to receive telemetry at all data rates.
- The capability of the RTS to interface with the FDS to obtain attitude sensor reports and to provide attitude data and displays.
- The capability of the LZP system to provide various data sets to the SDC.
- The capability of the SDC to receive various data sets from the LZP system.
- The capability of Nascom to provide the Data and Voice circuits sufficient to support this test.

6.15.2 Supporting Elements and Configurations

Hardware	Software
SDC	TBD
MIT/LL	TBD
FDS	TBD
LZP	TBD
RTS	TBD
- EO-1 Database	
CMS	TBD
Nascom	N/A
- Data and Voice Circuits as Described in Section 6.4.7	

6.15.3 Prerequisite

- Completion of element acceptance and initial interface tests.
- Completion of GSI&T Test #1 or GSI&T Test #2.
- Availability of EO-1 science data at all rates.

6.15.4 Test Stimulus

Stimulus	Source
EO-1 Telemetry Data S Band Rates X Band Rates Attitude Data	EO-1 Data Tapes or the real Spacecraft
EO-1 Command Data 2 kbps	MOC
Orbit / Attitude Products and data files	FDS
Various data sets and accounting / archival capability	CMS

6.15.5 Test Scenario / Description

- The MOC test conductor (TC) initializes all Data and Voice circuits according to the briefing message:

6.15 Test T6: Science Data Processing Test

- The GSI&T test director (TD) will provide the pretest briefing.
- The SDC, MOC, and spacecraft will be configured in accordance with the briefing message.
- MOC will receive all EO-1 telemetry data rates from the spacecraft and transmit 2 kbps real time commands and loads to the spacecraft.
- The RTS will ensure attitude data is transferred to the FDS.
- FDS will provide orbital and attitude data products to the RTS.
- LZP will receive, capture, process, store, and level zero process all telemetry from the spacecraft.
- Upon test completion, the TD will conduct a debriefing and terminate the test.
- Element test reports, supporting data, and Test Discrepancy Reports will be provided to the TD.
- Post test results of SDC will be provided to the TD.

6.15.6 Expected Results for Successful Test

- Verification of test requirements per criteria furnished in paragraph 6.4.7.
- Execution of information displays.
- Post test processing and playback verification of data tapes.

6.15.7 Test Requirements

Reference Number	Test Requirement	Test Objective (To Verify)
EX	LZP will provide daily processed science data sets to SDC within TBD days of MOC's receipt of last packet contained in the data set.	Command load error checks Constraint checks

All requirements to be tested will be listed in this table.

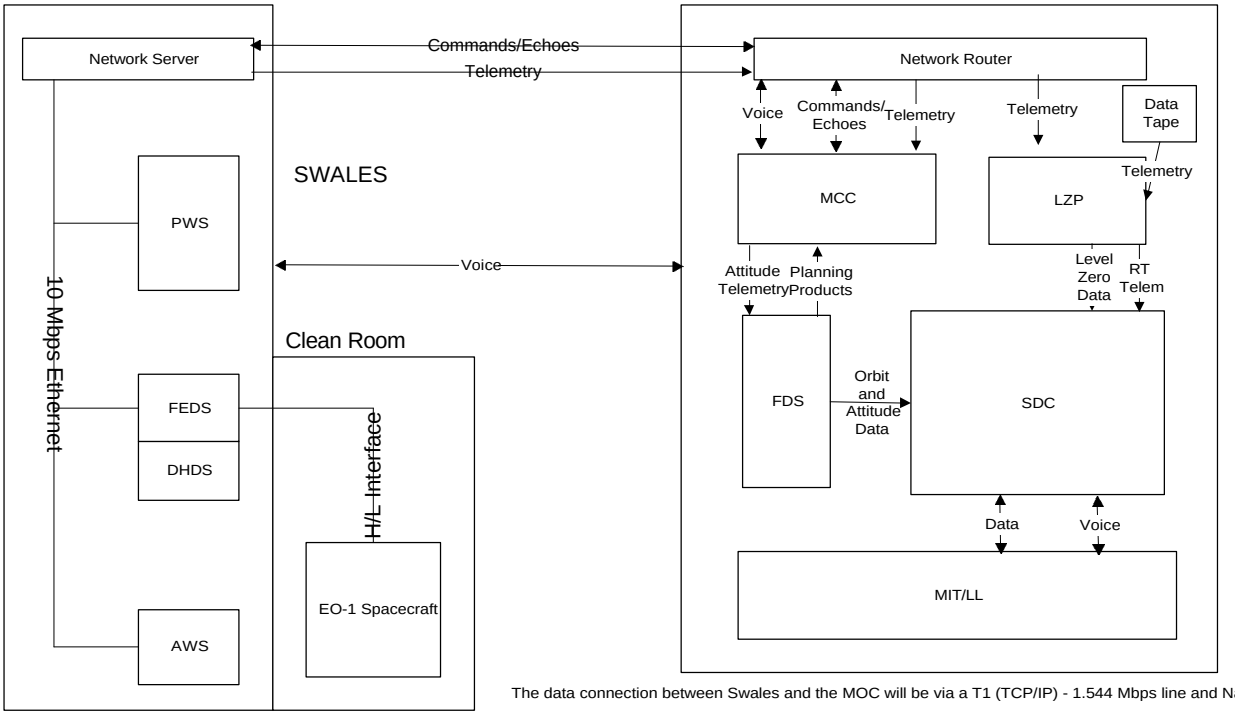


Figure 6-14: Test T6 Data Flow

6.16 Test T7: Spacecraft Computer Data Management Test

6.16.1 Test Overview (To Verify)

- The EGS's integrated capability to provide Spacecraft Computer loads and to uplink them to the EO-1 spacecraft in accordance with the test requirements in Section 6.5.7.
- The capability of the MOC to transmit command loads and to receive command echo verification.
- The capability of the RTS to interface with the CMS for the exchange of those loads, files, tables, reports, and displays necessary for the EO-1 command load and dump effort.
- The capability of the CMS to receive, generate, and deliver those items necessary for the EO-1 command load generation effort.
- The capability of flight software maintenance to provide table loads and uplink images to the CMS and to receive dump images from the CMS.
- The capability of the FDS to provide planning products to CMS and to provide weekly reports to the RTS and SDC.
- The capability of the SDC to interface with the RTS and CMS in order to transmit load generation files and to receive various reports from the FDS.
- The capability of the spacecraft to interface with the CMS in order to provide the science observation timeline and to receive validation reports.

6.16.2 Supporting Elements and Configurations

Hardware	Software
SDC	TBD
MIT/LL	TBD
FDS	TBD
LZP	TBD
RTS	TBD
- EO-1 Database	
CMS	TBD
Nascom	N/A
- Data and Voice Circuits	
as Described in Section 6.5.7	

6.16.3 Prerequisite

- Completion of element acceptance and initial interface tests.
- Completion of Ground Data Systems Test #2
- Availability of CMS generated EO-1 Spacecraft Computer loads.

6.16.4 Test Stimulus

Stimulus	Source
EO-1 Telemetry Data	EO-1 Data Tapes or the real Spacecraft
Science Observation Timeline	SDC
EO-1 Command Load Input	CMS
Dump Images/various files and table	RTS
Table loads and Uplink Images	Flight Software Maintenance
Planning Products	FDS

6.16.5 Test Scenario / Description

- Pre-test activities will include:

6.16 Test T7: Spacecraft Computer Data Management Test

- FDS will interface with CMS to transmit those files needed for load generation.
- SDC will interface with CMS to transmit science observation timeline.
- Flight software maintenance will interface with CMS to deliver the necessary tables, loads, and images needed for load generation.
- CMS will use the products received from FDS, SDC and flight software maintenance to generate loads needed to conduct this test.

- The GSI&T Test Director (TD) will provide a briefing message to ensure the completion of the off-line preparations.
- CMS will ensure reception and processing of all inputs necessary to produce EO-1 loads while maintaining continuity.
- CMS will electronically transfer all images, spacecraft computer loads, table loads, and flight software loads to the RTS.
- After good lock is established on the low rate data, the RTS will begin transmitting real time commands and loads to the spacecraft. Command echo verification is expected in the telemetry. This process will be repeated using all of the data rates and all of the supporting ground stations.
- Element test reports, supporting data, and Test Discrepancy Reports (TDR) will be provided to the TD.

6.16.6 Expected Results for Successful Test

- Verification of test requirements per criteria furnished in paragraph 6.5.7.
- Execution of information displays.
- Post test processing and analysis of dump images, table loads, and reports.

6.16.7 Test Requirements

Reference Number	Test Requirement	Test Objective (To Verify)
EX	CMS will perform command load error and constraint checks.	Command load error checks Constraint checks

All requirements to be tested will be listed in this table.

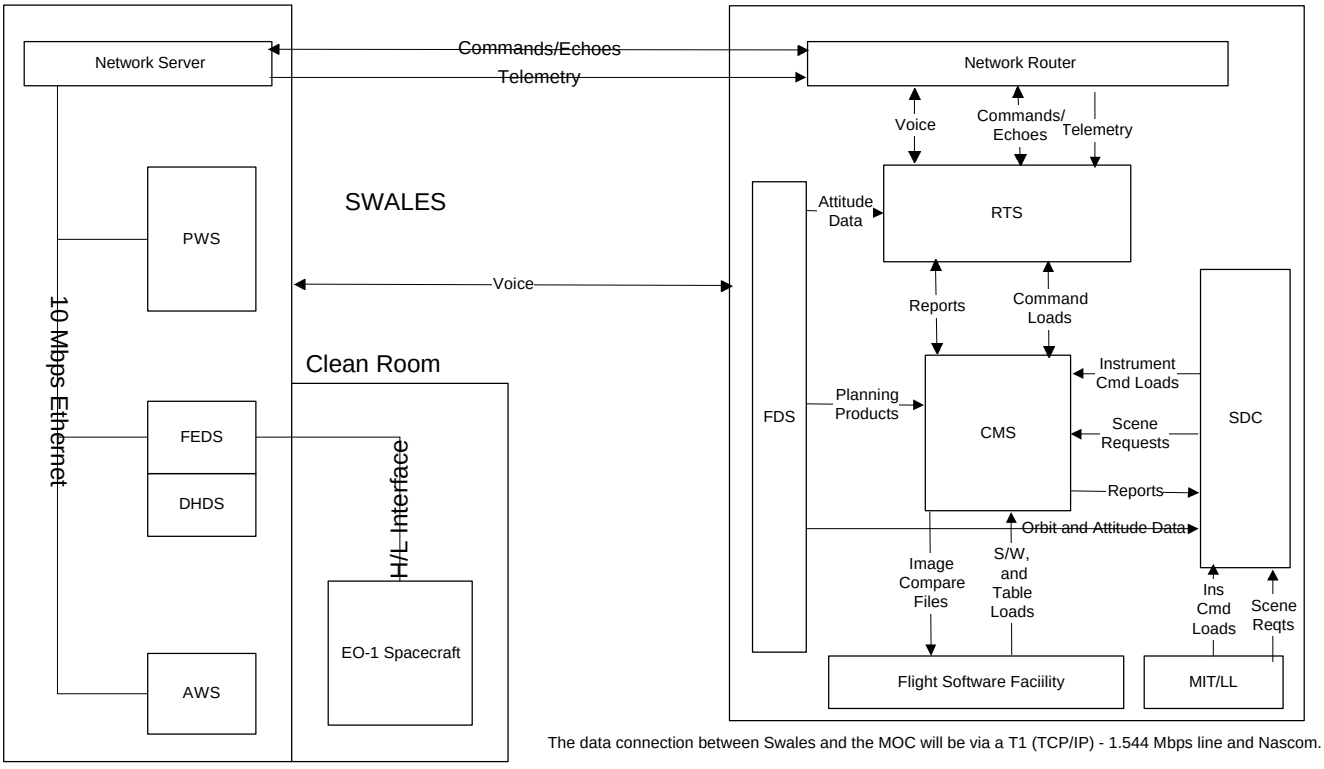


Figure 6-15: Test T7 Data Flow

6.17 Test T8: Telemetry, Tracking, and Command Data Processing Test

6.17.1 Test Overview (To Verify)

- The EGS's integrated capability to receive and forward telemetry, commands, and tracking data in support of EO-1 operations in accordance with the test requirements in Section 6.6.7.
- The capability of the ground station to transfer telemetry at all data rates. The ground station will receive 2 kbps real time commands and loads for uplink. The ground station will send schedule updates to all elements.
- The capability of the backup ground stations to transfer telemetry at all applicable data rates. The ground station will receive 2 kbps real time commands and loads for uplink
- The capability of all ground stations used to provide an interface to the MOC for telemetry and commanding.
- The capability of the MOC to receive, capture, process, and store real time and recorded telemetry at all rates. The MOC will transmit 2 kbps real time commands and loads to the ground sites.
- The capability of FDS to receive ground site tracking data and produce acquisition data, attitude verification, and planning prediction reports.
- The capability of CMS to generate command loads and transfer conflict-free loads to the MOC.
- The capability of LZP to receive, record, process, and archive EO-1 science data at all telemetry rates. LZP will send real time and level zero data sets to the SDC.
- The capability of SDC to receive real time and level zero data sets directly from LZP.
- The capability of Nascom to provide the Data and Voice circuits sufficient to support this test.

6.17.2 Supporting Elements and Configurations

Hardware	Software
SDC	TBD
MIT/LL	TBD
FDS	TBD
LZP	TBD
RTS	TBD
- EO-1 Database	
CMS	TBD
Ground Station	TBD
- EO-1 Hardware String	
- EO-1 Scheduling System	
- EO-1 Software	
Nascom	N/A
- Data and Voice Circuits as Described in Section 6.1.7	

6.17.3 Prerequisite

- Completion of element acceptance and initial interface tests.
- EO-1 telemetry data tape and test equipment at the ground stations.
- Availability of station software to process telemetry and command data.
- Availability of ground station scheduling system.

6.17.4 Test Stimulus

Stimulus	Source

6.17 Test T8: Telemetry, Tracking, and Command Data Processing Test	
EO-1 Telemetry Data	EO-1 Data Tapes or the real Spacecraft
EO-1 Command Data	MOC
Ground station scheduling facility	Ground station scheduling system
Orbit/attitude Products	FDS
Attitude data to FDS	RTS

6.17.5 Test Scenario / Description

- The MOC Test Conductor (TC) initializes all Data and voice circuits according to the briefing message.
- The GSI&T Test Director (TD) will provide the pre test briefing.
- All ground stations will interface with the MOC for command and telemetry data. Prior to the test, Wallops scheduling will produce all ground support schedules and furnish them to the MOC and other ground sites.
- All ground stations will provide pre pass checks prior to the test.
- All ground stations will provide the MOC with statistics on station time delay measurements and clock correlation's.
- The MOC will provide 2 kbps commands to the ground station sites and receive command verification via telemetry and command echoes.
- The MOC will receive, record, process, and archive telemetry at all rates. In addition, attitude data will be transferred to FDS.
- FDS will provide acquisition data to the sites. Acquisition and orbital and attitude data products will be provided to the RTS.
- FDS will receive tracking data from all applicable sites.
- LZP will receive, record, process, archive, and display data quality statistics in real time. LZP will provide real time and level zero data sets to the SDC.
- SDC will receive real time and level zero data sets directly from the LZP.
- Upon test completion, the TD will conduct a debriefing and then release all supporting elements.
- Element test reports, supporting data, and Test Discrepancy Reports will be provided to the TD.

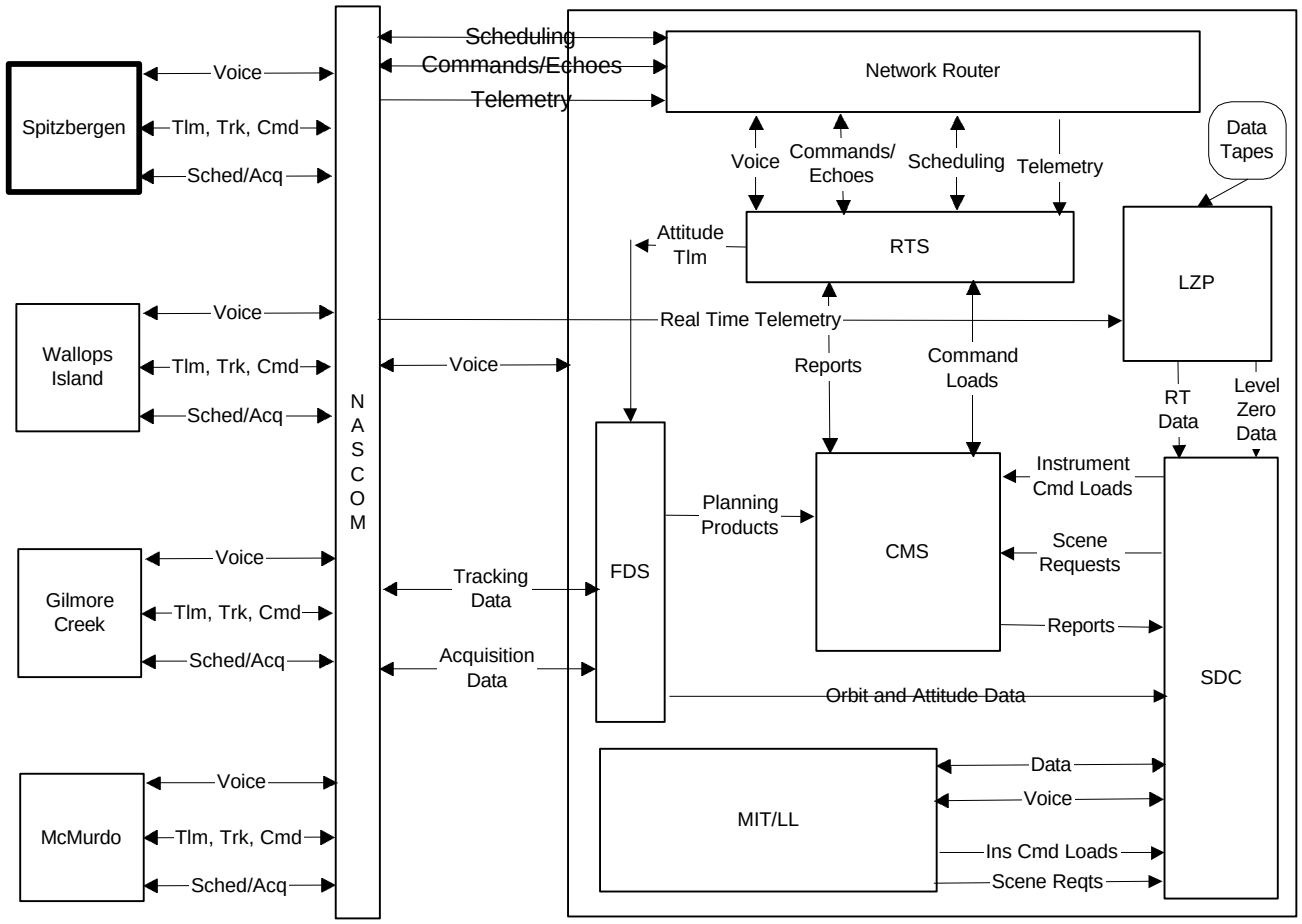
6.17.6 Expected Results for Successful Test

- Command transmission along with reception / verification from telemetry, recording, processing, and data transfer by the EGS.
- Verification of test requirements per criteria furnished in paragraph 6.6.7.
- Execution of information displays.
- Post test processing of data (archive / history / attitude) and tapes.

6.17.7 Test Requirements

Reference Number	Test Requirement	Test Objective (To Verify)
EX	CMS will perform command load error and constraint checks.	Command load error checks Constraint checks

All requirements to be tested will be listed in this table.



The data connection between Swales and the MOC will be via a T1 (TCP/IP) - 1.544 Mbps line and Nascom.

Figure 6-16: Test T8 Data Flow

6.18 Test T9: Launch Site Interface to the EGS Test

6.18.1 Test Overview (To Verify)

- The EGS's integrated capability to provide command and telemetry processing to and from the EO-1 spacecraft when located at the Launch Site(WTR) in accordance with the test requirements in Section 6.7.7.
- The capability of the MOC to transmit 2 kbps real time commands and loads to the EO-1 spacecraft while at WTR. The MOC will also receive telemetry at TBD rates, and command echoes.
- The capability of the MOC to transfer TBD telemetry to the ground support equipment located at WTR during L&EO.
- The capability of LZP to receive, capture, process, and store telemetry at the rates supplied by the launch site. LZP will provide real time and level zero data sets to SDC.
- The capability of FDS to receive tracking data from the launch site and to provide acquisition data to WTR and other supporting ground stations during L&EO.
- The capability of SDC to receive real time and level zero data sets directly from LZP.
- The capability of Nascom to provide the Data and Voice circuits sufficient to support this test.

6.18.2 Supporting Elements and Configurations

Hardware	Software
SDC	TBD
MIT/LL	TBD
FDS	TBD
LZP	TBD
RTS	TBD
- EO-1 Database	
CMS	TBD
Ground Station	N/A
Utilize T1 or tapes	
Launch Site	TBD
Interface TBD	
T1 Line	TBD
Nascom	N/A
- Data and Voice Circuits as Described in Section 6.1.7	

6.18.3 Prerequisite

- Completion of element acceptance and initial interface tests.
- Completion of GSI&T tests number T1 through T9.
- Availability of launch site facilities.

6.18.4 Test Stimulus

Stimulus	Source
EO-1 Telemetry Data	EO-1 Data Tapes or the real Spacecraft
EO-1 Command Data	RTS
EO-1 Tracking Data	Station
EO-1 Acquisition Data	FDS

6.18.5 Test Scenario / Description

6.18 Test T9: Launch Site Interface to the EGS Test

- The GSI&T Test Director (TD) initializes all Data and Voice circuits according to the briefing message and provides a pretest briefing.
- WTR will ensure proper line configuration at their site so that the spacecraft can receive commands and loads from the MOC.
- The spacecraft will provide TBD telemetry to the MOC.
- The MOC will transfer low rate data back to the ground support equipment at WTR.
- LZP will receive, capture, process, and store telemetry at TBD data rates.
- LZP will send real time data sets directly to the SDC.
- FDS will receive tracking data from the launch site and will provide acquisition data to all supporting sites during L&EO.
- SDC will receive real time data sets directly from the LZP.
- Upon test completion, the TD will conduct a debriefing and then release all supporting elements.
- Element test reports, supporting data, and Test Discrepancy Reports will be provided to the TD.

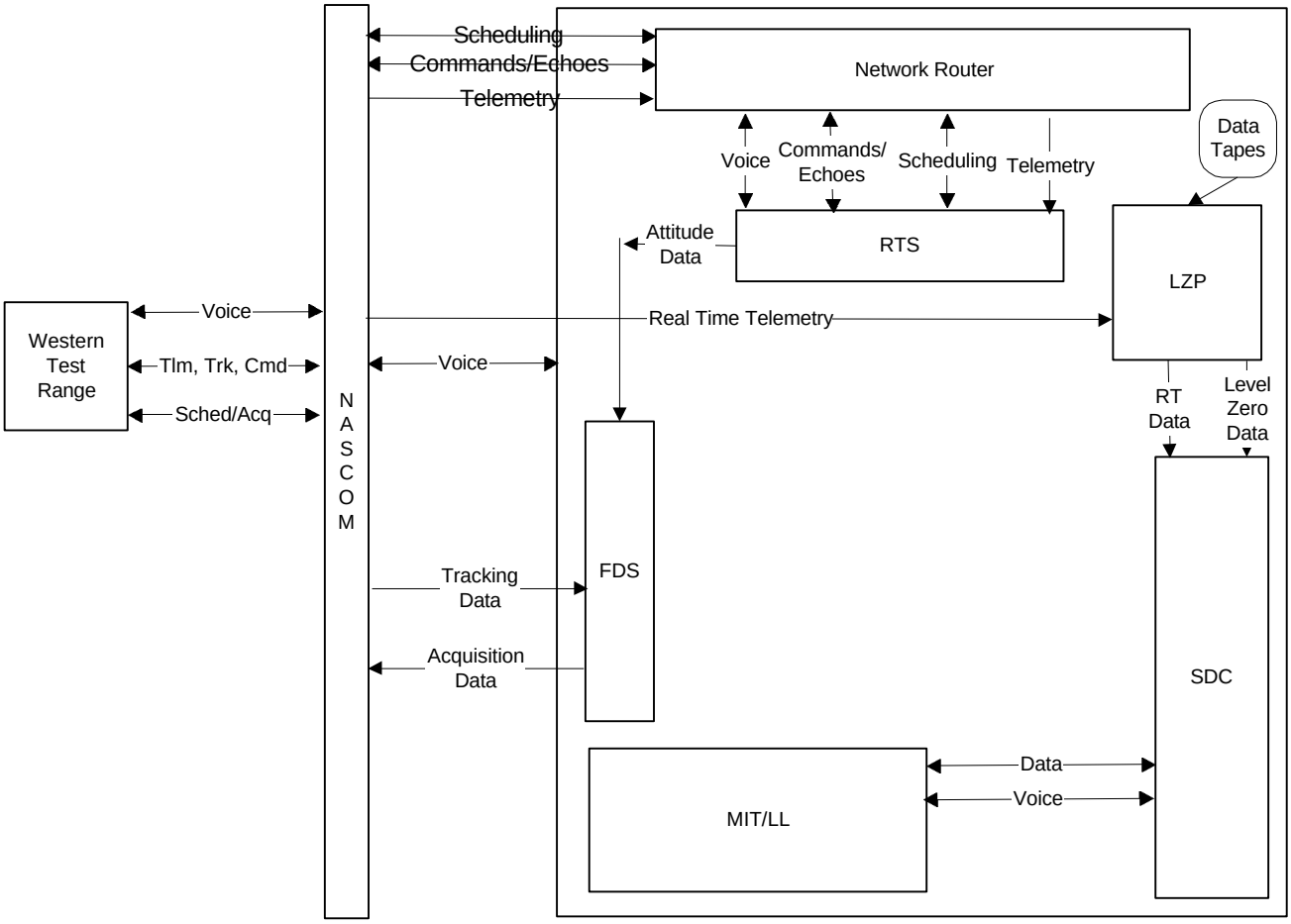
6.18.6 Expected Results for Successful Test

- The Launch site capability to transmit data to the RTS.
- Verification of command and load transmission to the Launch site.
- Verification of test requirements per criteria furnished in paragraph 6.7.7.

6.18.7 Test Requirements

Reference Number	Test Requirement	Test Objective (To Verify)
EX	FDS will provide acquisition data to the ground stations.	Acquisition data

All requirements to be tested will be listed in this table.



The data connection between the WTR and the MOC will be via TBD and Nascom.

Figure 6-17: Test T9 Data Flow

6.19 Test T10: Fully Integrated EGS Test

6.19.1 Test Overview (To Verify)

- The EGS's integrated capability to provide EO-1 telemetry, command, and tracking data in support of spacecraft operations, control, and science data goals in accordance with the test requirements in Section 6.8.7.
- The capability of all ground stations to transmit telemetry at all data rates and accept commanding.
- The capability of the MOC to transmit real time commands and loads and to receive telemetry at all rates while in all ground station modes in preparation for L&EO activities.
- The capability of the MOC to transfer data among all its internal elements (RTS, FDS, LZP, CMS).
- The capability of the MOC to receive from the main ground station an accurate, complete, and current schedule of all ground stations support.
- The capability of the RTS to interface with the CMS for the transfer of command loads, tables, images, files, and reports required for EO-1 load transmission.
- The capability of CMS to interface with FDS, RTS, software maintenance facility, and SDC to obtain those files, inputs, images, and updates required for load generation.
- The capability of FDS to receive tracking data and transmit acquisition data to all supporting ground stations. FDS will generate and transfer planning products to the CMS.
- The capability of flight software maintenance to receive, maintain, and provide flight software and downlink images necessary to generate table and image updates for the MOC.
- The capability of LZP to receive, process, and archive telemetry at all data rates.
- The capability of SDC and the ground support equipment to interface with the RTS and CMS for transmission and receipt of those tables, commands, and files required for load generation.
- The capability of SDC to receive real time and level zero data sets directly from LZP.
- The capability of Nascom to provide the Data and Voice circuits sufficient to support this test.

6.19.2 Supporting Elements and Configurations

Hardware	Software
SDC	TBD
MIT/LL	TBD
FDS	TBD
LZP	TBD
RTS	TBD
- EO-1 Database	
CMS	TBD
Ground station	TBD
- Scheduling system	
Nascom	N/A
- Data and Voice Circuits as Described in Section 6.1.7	

6.19.3 Prerequisite

- Completion of element acceptance and initial interface tests.
- Completion of Ground Data Systems testing through test 9.

6.19.4 Test Stimulus

Stimulus	Source

6.19 Test T10: Fully Integrated EGS Test

EO-1 Telemetry Data	EO-1 Data Tapes or the real Spacecraft
EO-1 Command Data	MOC
Daily command loads, pass plans, and printouts	CMS
EO-1 data products/Vectors	FDS
Project data base	Spacecraft Contractor
Flight software/Table images	Flight Software Maintenance
Scheduling system equipment	Ground Station

6.19.5 Test Scenario / Description

- Prior to test start, FDS will provide data products / vectors (electronically and hardcopy) to the RTS and supporting ground sites.
- CMS will interface with the RTS, FDS, SDC, ground support equipment, and flight software maintenance to obtain inputs necessary for EO-1 load generation.
- The FOT will ensure that all interface activity is functioning properly. Files, data sets, reports, and listings will be sent to their proper destinations.
- At the start of the test, the MOC Test Conductor (TC) will initialize all Data and Voice circuits according to the briefing message.
- The GSI&T Test Director (TD) will provide the pretest briefing.
- The MOC will receive all telemetry rates and data formats from all the supporting ground sites. Also, the MOC will transmit real time 2 kbps commands and loads to the supporting sites.
- LZP will record, process, and archive all telemetry data at all rates and formats.
- SDC will ensure the interface to the CMS in order to transmit those items necessary for load generation.
- Upon test completion, the TD will conduct a debriefing and then release all supporting elements.
- Element test reports, supporting data, and Test Discrepancy Reports will be provided to the TD.
- Post test, SDC and the ground support equipment will receive real time data sets directly from LZP.

6.19.6 Expected Results for Successful Test

- Command transmission along with reception / verification from telemetry, recording, processing, and data transfer by the EGS.
- Verification of all EO-1 test requirements per criteria furnished in paragraph 6.8.7 of this test sheet.
- Post test processing of data (attitude / archive / history) and tapes.

6.19.7 Test Requirements

Reference Number	Test Requirement	Test Objective (To Verify)
EX	CMS will perform command load error and constraint checks.	Command load error checks Constraint checks

All requirements to be tested will be listed in this table.

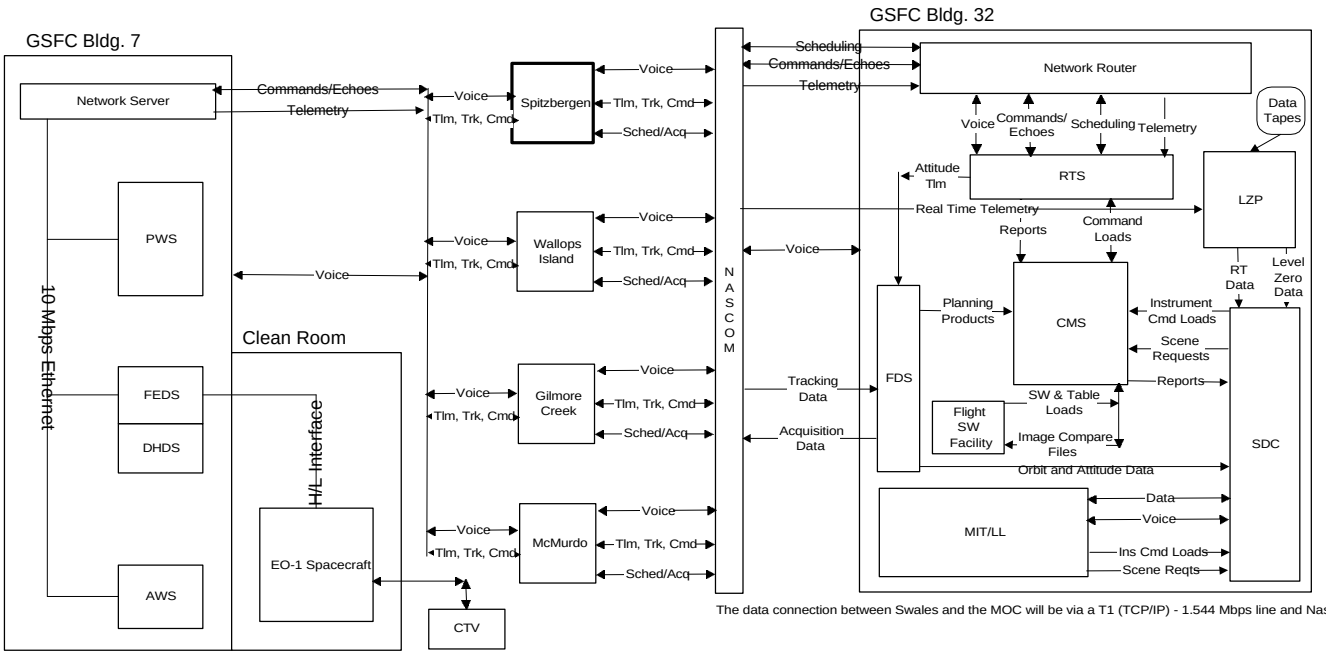


Figure 6-18: Test T10 Data Flow

6.20 Operations Simulations

6.20.1 Test Overview (To Verify)

- Mission simulations will be held throughout the pre launch period as often as possible.
- The tests described here will be held during the spacecraft thermal vacuum test.
- There will be 4 of these tests, each lasting 8 hours. Some contingency passes will be mixed in an unpredictable fashion.
- Each mission phase will be simulated.

6.20.2 Supporting Elements and Configurations

Hardware	Software
EO-1 Database	Current Release
Spacecraft	TBD
MCC	Current release
CMS	Current release
LZP	Current release
Nascom	N/A
Flight software facility	TBD
SDC	TBD

6.20.3 Prerequisite

- N/A

6.20.4 Test Stimulus

Stimulus	Source
N/A	

6.20.5 Test Scenario / Description

- The FOT will conduct at least 4 mission simulations from the MOC during Thermal Vacuum, probably during thermal transitions. Planned simulations include:
    - L&EO
    - Instrument Initialization and Checkout
    - Normal Operations
    - Contingency Operations ("Mystery Passes")
- "Mystery Passes" refer to unrehearsed operations simulations where the Spacecraft I&T team initializes the spacecraft in a non-standard/anomalous configuration. The FOT is then tasked with The current accepted release of all software will be used.
- Current software releases will be used for these tests.
- Data will be flowed in parallel to all necessary agents.
- The LZP will transfer data to the SDC for analysis.
- Offline processing of the data will be performed after testing. These activities will include:
    - History delog/replay.
    - Report generation.
    - Trending operations.
    - Data archival.
- Due to the criticality of testing in the Thermal Vacuum environment, the spacecraft I&T team will carefully review all operational procedures prior to the test.

6.20 Operations Simulations
• Hand-over to and from the I&T team will be in a mutually agreed upon configuration. • Any FOT members working actively in I&T will be in the MOC for these simulations.

Note:
The data flow diagrams for the simulations will vary according to the stage of development of the EGS. The data flow will follow the previous figures in this document.

6.21 End To End Data Flow Simulation

6.21.1 Test Overview (To Verify)

- Simulate normal operations ground stations contacts.
- Train the FOT in pass operation activities.

6.21.2 Supporting Elements and Configurations

Hardware	Software
EO-1 Database	Current Release
Spacecraft	TBD
MCC	Current release
CMS	Current release
LZP	Current release
Nascom	N/A
Flight software facility	TBD
SDC	TBD
Wallops Station	TBD
Alaska Station	TBD
McMurdo Station	TBD
TDRSS	TBD

6.21.3 Prerequisite

- Test data tapes sent to the ground stations.

6.21.4 Test Stimulus

Stimulus	Source
Ground station software	Ground station

6.21.5 Test Scenario / Description

- This series of tests will simulate ground station passes using test tapes made previously.
- Data will be flowed in parallel to the MCC and the LZP for these tests.
- Current software releases will be used for these tests.
- Commands will be sent to the ground stations but the only verification will be the command echo return link.
- Ground stations will perform Virtual Channel “Strip and Ship”.
- MCC will perform attitude extraction and transfer files to FDS.
- The LZP will transfer data to the SDC for analysis.
- Off-line processing of the data will be performed after testing. These activities will include:
    - History de-log/replay.
    - Report generation.
    - Trending operations.
    - Data archival.
- The complete mission planning process will be exercised, from the scheduling of contacts to generation of command loads.
- These rehearsals will be scheduled as often as possible and necessary to ensure that all ground system elements are efficient at normal operations procedures.

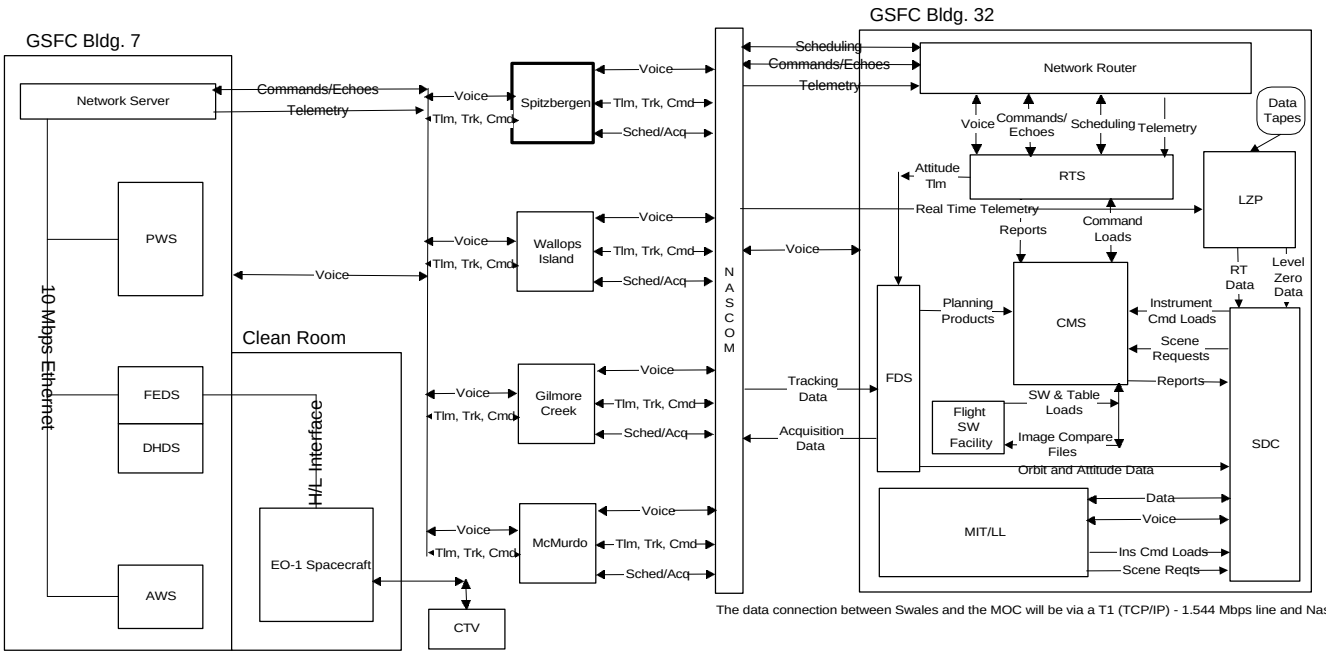


Figure 6-19: End to End Data Flow Simulation Data Flow

6.22 Launch Site Testing

6.22.1 Test Overview (To Verify)

- Verify MOC telemetry and command capability in interfacing with the launch site.
- Prepare the FOT for launch countdown.

6.22.2 Supporting Elements and Configurations

Hardware	Software
SDC	TBD
MIT/LL	TBD
FDS	TBD
LZP	TBD
RTS	TBD
- EO-1 Database	
CMS	TBD
Ground Station	N/A
Utilize T1 or tapes	
Launch Site	TBD
Interface TBD	
T1 Line	TBD
Nascom	N/A
- Data and Voice Circuits	
as Described in Section 6.1.7	

6.22.3 Prerequisite

- Spacecraft shipped to launch site.

6.22.4 Test Stimulus

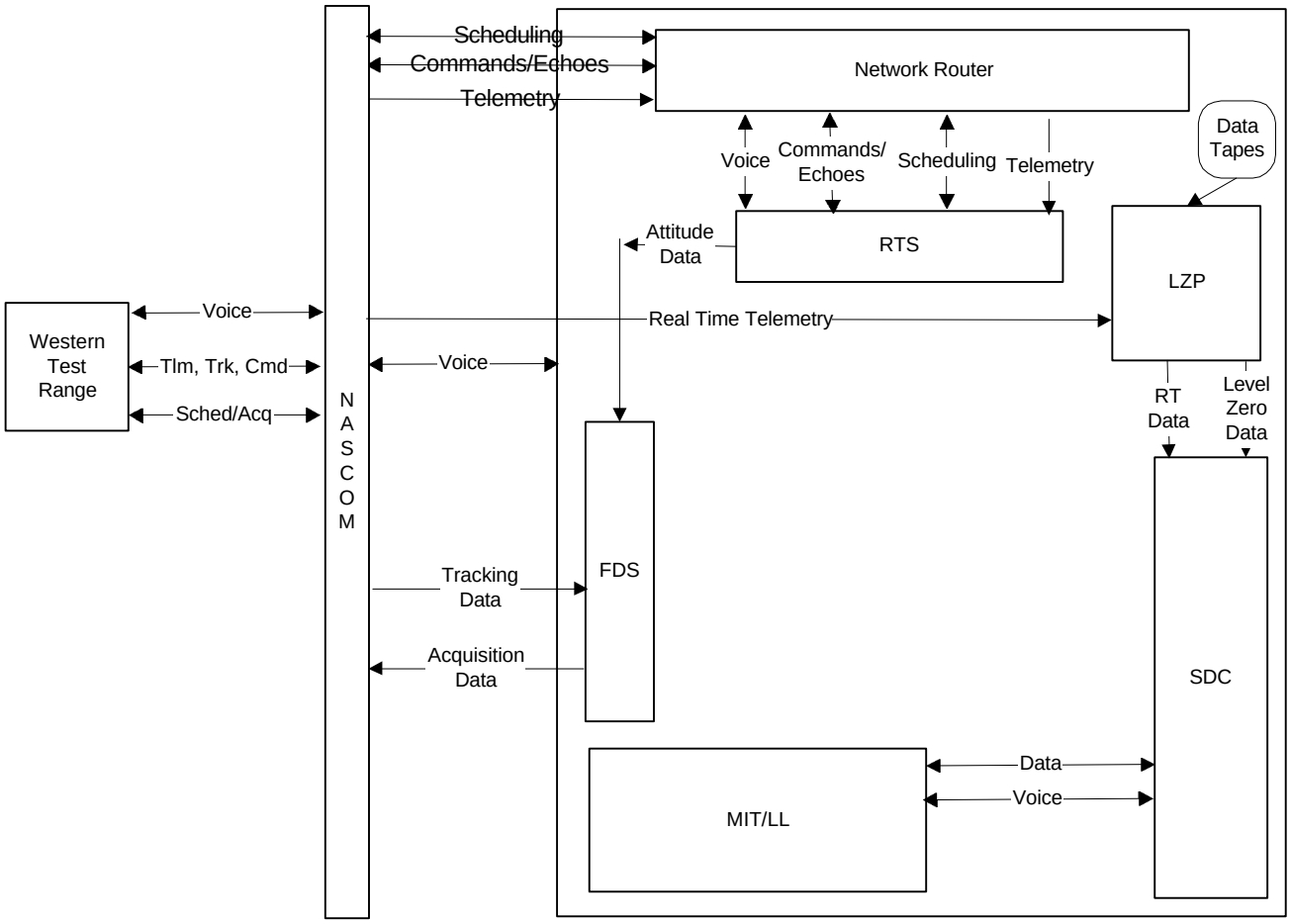
Stimulus	Source
EO-1 Telemetry Data	EO-1 Data Tapes or the real Spacecraft
EO-1 Command Data	RTS
EO-1 Tracking Data	Station
EO-1 Acquisition Data	FDS

6.22.5 Test Scenario / Description

- Two types of tests will be performed while the spacecraft is at the launch site; a spacecraft test and a launch countdown test.
- Spacecraft testing:
  - Last opportunity for the MOC to command the spacecraft prior to launch.
  - L&EO simulations previously performed during Thermal Vacuum will be performed again.
  - Any untested L&EO procedures will be tested.
  - MCC will perform attitude extraction and transfer the data files to the FDS.
  - Data will be flowed in parallel to the MCC and the LZP for these tests.
  - Current software releases will be used for these tests.
  - Handover of the spacecraft will be in a mutually agreed upon configuration.
  - Trending operations will be performed.
- Launch countdown testing:
  - This test will involve a series of data flows from the ground stations.

6.22 Launch Site Testing

- All phases of mission countdown will be simulated, including "Go/No-Go" polling of elements viw voice net communication.
- Mission Readiness Test Manager will coordinate ground network involvement.
- The launch script will be provided by the launch vehicle contractor.



The data connection between the WTR and the MOC will be via TBD and Nascom.

Figure 6-20: Launch Site Testing Simulation Data Flow

Section 7. Requirements Versus Test Matrix

This section contains the EO-1 mission support requirements versus test matrix. Element requirements being tested during a specific GSI&T test are identified with a "P" or "V", indicating "Partial" or "Full Verification". This matrix is a projected verification plan and actual results will be compiled in a post testing matrix.

Test Requirements	Ref. #	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7	Test 8	Test Objectives (To Verify)
CMS will perform command load error and constraint checks.	EX	V		P		P	V		V	Command load error checks Constraint checks

Section 8. Test Resources

8.1 General

This section provides descriptions of test facilities and systems used for integrated ground data system testing.

8.2 Test Time

Test time will be very valuable on EO-1. Many aspects of testing can be accomplished in various forums. Whenever possible, each test listed in Section 6 will be held as a separate test, but if circumstances warrant, some tests may have to be combined. How this will be done is TBD.

There will be a T1 line between Swales and GSFC which will be sending 32 Kbps housekeeping telemetry data to GSFC at all times (dependent upon the spacecraft being turned on). An ASIST workstation can be connected to this line in the MOC as a remote terminal to monitor the spacecraft I&T activities. It can also help in the development of the MOC systems.

There is time allocated for FOT commanding of the spacecraft while it is at Swales, as well as during environmental testing at GSFC. See Section 9 for detailed commanding availability times allocated by the spacecraft contractor to be dedicated to the FOT. Commanding can also be scheduled in other short time periods during the time the spacecraft is at Swales. Off shift testing time can be used when time with the spacecraft is tight.

More time can be gained through the use of FLATSAT data, although the data will not be as comprehensive as it will be later in the integration phase. The FOT test conductor will be present for all stages of GSI&T (TBD), and will help organize testing opportunities. The FLATSAT data will not be very useful, as it will not represent a complete set of data. But empty data sets sent from the FLATSAT could be used to help determine whether the MOC systems are even capable of receiving any data from the spacecraft.

Thermal vacuum time can be used to run simulations to test the functionality of the FOT as well as FOT support personnel. This time cannot be used for testing of hardware and software, however. This testing must have been performed before this time to work out major discrepancies. This is especially true considering the fact that the software being used is mostly new to operations and needs more testing than currently operational system have in the past. Many of the planned simulations will be held during thermal vacuum.

The ADCS flight software development facility in Building 11 Room E114 will be connected to the MOC (this interface is TBD) to provide test data for flight dynamics functions. This facility will be available early on in the program.

Time is available while the spacecraft is at the launch site in the off-line facility to perform command and telemetry response tests. See Sections 6.22and 6.18 for details on these tests.

8.3 Test Data Sources

The ideal test source is the EO-1 spacecraft. The spacecraft will be available on and off during FLATSAT and spacecraft I&T. Telemetry will be sent to the MOC whenever the spacecraft is on, as well as any time necessary or allocated to run a ground system test.

Another source of data are the spacecraft breadboards which will be used in the spacecraft flight software development facility. This data will be available on and off to the MOC as well, and will be especially useful in testing the FDS software.

Recorded spacecraft data can be used as telemetry as well. This type of data will be useful in testing outside elements as well as re-conducting tests that didn't go well. This data can also be used to test archiving and other data manipulation abilities.

Another source of data available is other on-orbit spacecraft. Only limited testing can be performed using another spacecraft, but high level and preliminary tests can be accomplished using this data source.

A data generator can provide a simulated data stream from the ground station to selected users for debugging purposes. The use of a data generator is TBD at this time.

The following table shows the available data sources, the type of data they are capable of producing, and their availability.

Source	Content	Data Rates	Availability
Flight Software Development Lab	Selected APIDs, VC0, 1, and 2	TBD	High
Data Generator	TBD	TBD	TBD
Recorded Data	All APIDs	All rates	High
Spacecraft Data	All APIDs	All rates	See Section 9
Other Spacecraft	TBD	TBD	TBD

Section 9. GSI&T Forecast Schedule

This section contains the timeline forecast schedule of the EO-1 GSI&T activities. This timeline will be used for planning the tests described in Section 6 of this document. The MRTT will determine the actual test dates.

The following table shows a top level schedule to be followed by the spacecraft I&T. The times in bold have been set aside for specific EGS tests.

Activity	Start Time	End Time
FLATSAT	1/5/98	4/2/98
Bus Integration	4/2/98	12/11/98
Start I&T Flow	4/3/98	
Mongoose V Software Test	5/1/98	5/4/98
Mongoose V Functional	5/5/98	5/11/98
Baseline EGS Test (T1)	**5/19/98**	**5/20/98**
ACS Software Test	6/10/98	6/12/98
ACS Phasing Test	6/15/98	6/17/98
EGS Telemetry and Command Data Processing Test (T2)	**6/19/98**	**6/22/98**
EGS FDS Test (Attitude System) (T3)	**6/23/98**	**6/23/98**
Deploy Solar Arrays	7/28/98	7/30/98
Baseline System Functional Test	8/3/98	8/10/98
EGS Command Management Test (T5)	**8/11/98**	**8/11/98**
EGS Spacecraft Computer Processing Test (T7)	**8/12/98**	**8/12/98**
Stand Down	8/13/98	11/27/98
EGS Spare Time With Spacecraft	**11/30/98**	**12/11/98**
Payload Integration	12/14/98	12/23/98
ALI Functional	12/28/98	12/28/98
Comprehensive Performance Testing	12/31/98	1/15/99
EGS Fully Integrated Ground System Test (T9)	**1/11/99 2nd Shift**	**1/15/99 2nd Shift**
Environmental Testing	1/26/99	3/25/99
Vibration Test	2/3/99	2/9/99
Acoustic Test	2/11/99	2/12/99
EMI Test	2/17/99	2/23/99
EGS Operations Simulations	**2/26/99 2nd Shift**	**3/1/99 2nd Shift**
EGS End to End Data Flow Simulation	**3/12/99 2nd Shift**	**3/15/99 2nd Shift**
Thermal Vacuum	3/5/99	3/15/99
Ambient Functional	3/17/99	3/17/99
RF Compatibility Test	3/18/99	3/18/99
Launch Site Operations	3/26/99	5/31/99
Unpack and Checkout	4/9/99	4/16/99
EGS Launch Site Testing	**4/21/99**	**4/21/99**
Turnover to OLS/Launch	5/4/99	5/4/99

All functional tests and ground GSI&T tests should be complete by the end of 1998. The time available in the I&T flow is sufficient to perform all tests except the Baseline EGS Test T1. Only 2 days are available, and 5 are needed. The time allotted for test T2 is more than is necessary, so if the time given to that test is rearranged to be given to test T1, all the necessary time to test the EGS is available.

Some of the GSI&T tests are not accounted for in the above schedule. These tests will be performed whenever time is available. These tests may have to be scheduled after hours.

Section 10. Test Discrepancy Reporting System

This section details the TDR system to be used during EGS I&T. The MRM and MRTT will jointly utilize this system. The TDR system provides for the logging, rerouting, prioritizing, tracking, and resolution of system discrepancies discovered during the EGS I&T. All interfaces will be tested during the MRT sponsored I&T phase. The TDR system is an independent directorate discrepancy reporting system. It is not subject to any internal discrepancy reporting systems maintained by elements of the EGS. A discrepancy is defined as the failure, by error or omission, of a deliverable hardware, software, or documentation item needed to satisfy the project's ground data system requirements.

Note:
This whole section is TBD, it has not been determined whether EO-1 will be using this system.

Abbreviations and Acronyms

ACS	Attitude Control System
ADCS	Attitude Determination and Control System
ALI	Advanced Land Imager
AWOTS	Automated Wallops Orbital Tracking Station
CCSDS	Consultative Committee for Space Data Standards
CMD	Command
CMS	Command Management System
CRT	Cathode Ray Tube
DMR	Detailed Mission Requirements
DR	Discrepancy Report
EGS	EO-1 Ground System
EO-1	Earth Orbiter 1
ER	Element Representative
ETM+	Enhanced Thematic Mapper Plus
FDS	Flight Dynamics Subsystem
FOT	Flight Operations Team
FTP	File Transfer Protocol
GSFC	Goddard Space Flight Center
GSI&T	Ground System Integration and Test
I&T	Integration and Test
L&EO	Launch and Early Orbit
LL	Lincoln Labs
LP DAAC	EOSDIS Land Processes Distributed Active Archive Center
LZP	Level Zero Processor
MCC	Mission Command and Control
MIT	Massachusetts Institute of Technology
MOC	Mission Operations Center
MRM	Mission Readiness Manager
MRT	Mission Readiness Testing
MRTE	Mission Readiness Test Engineer
MRTT	Mission Readiness Test Team
N/A	Not Applicable
NASA	National Aeronautics and Space Administration
Nascom	NASA Communications Division
NMP	New Millennium Program
ODB	Operational DataBase
Ops	Operations
ORPA	Operations Readiness and Performance Assurance
PDB	Project DataBase
PKF	Poker Flats
PSAT	Preliminary Site Acquisition Table

RF	Radio Frequency
RT	Real-time
RTS	Real Time System
S/C	Spacecraft
SDC	Science Data Center
SFDU	Standard Formatted Data Units
SSR	Solid State Recorder
SWG	Science Working Group
TBC, D, R or S	To Be Confirmed, Determined, Received, or Supplied
TC	Test Conductor
TCP/IP	Transmission Control Program/Internet Protocol
TD	Test Director
TDR	Test Discrepancy Report
TDRSS	Tracking and Data Relay Satellite System
TIS	Test Information Sheet
TLM	Telemetry
TRB	TDR Review Board
USGS	U.S. Geological Survey
VC	Virtual Channel
WARP	Wideband Advanced Recorder Processor
WPS	Wallops
WSG	Wallops Scheduling Group